The Electrical Industry's Weekly Magazine

December 31, 1956

Electrical World

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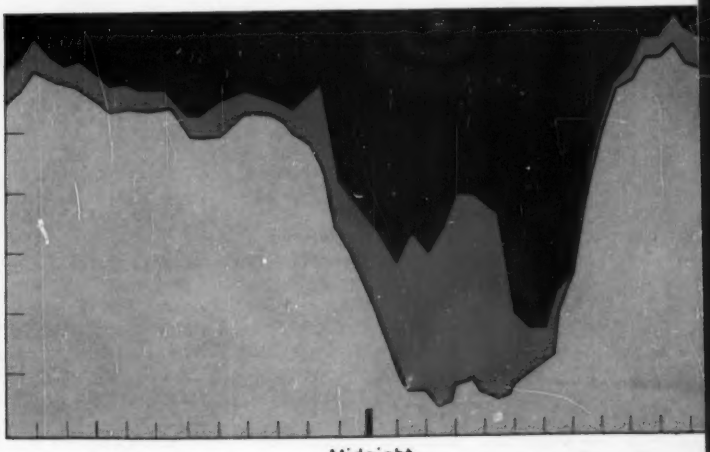
350-Mw Wind Tunnel Fills Valley in CEI Load

...Page 16



Midnight

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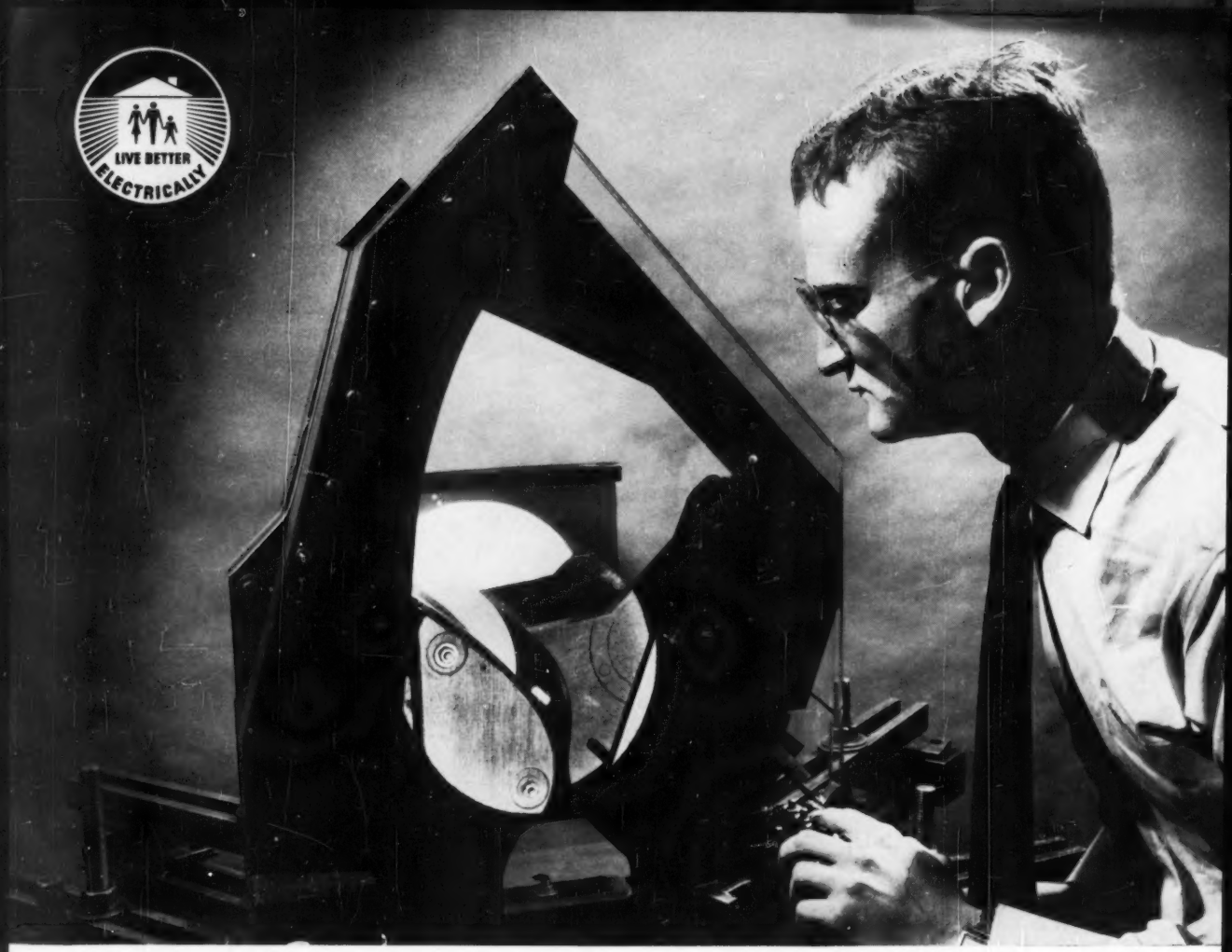

FLOW CONFIGURATIONS are observed in shadow box used with model of transverse section of new intercept valve in Air Test Lab of General Electric's Large Steam Turbine-Generator Dept. Erik Vohtz, Development Engineer, studies flow pattern existing at one particular valve position.

Turbine advances speeded by Air Test Lab

Aerodynamic studies accelerate new, improved steam turbine designs

Today's steam turbines operate at such high efficiencies that further improvements are made only through carefully planned research and development. At General Electric, the Air Test Laboratory is one of the most vital tools used for gathering data to speed the translation of new turbines' designs into practical applications.

UTILITY BENEFITS

A complete understanding of flow phenomena becomes increasingly important to effect greater economies available from increased turbine ratings, steam pressures and operating temperatures. Studies on nozzles, buckets and other turbine components conducted in the Air Test Lab contribute to this understanding. The results of this work are passed along as benefits in the form of more efficient turbine parts. For example, the axial exhaust hood, developed in the Air Test Lab, recovers a large part of the velocity energy leaving the last-stage buckets, and improves overall turbine performance about 0.4%. A recent study of a 200,000-kw unit incorporating this design indicated a possible evaluated fuel saving of $100,000.

NEW VALVE

One of the most significant studies now under way in the Air Test Lab is on a new intercept valve, which in addition to performing the normal functions of a valve, will separate out foreign materials. This program gives excellent promise of substantially reducing or eliminating the existing problem of foreign material damaging steam parts.

For information concerning the latest turbine advances, contact your General Electric Sales Office. General Electric Company, Section 301-287, Schenectady 5, New York.

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Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or supplying electric power

Vol. 146 No. 27 **December 31, 1956**

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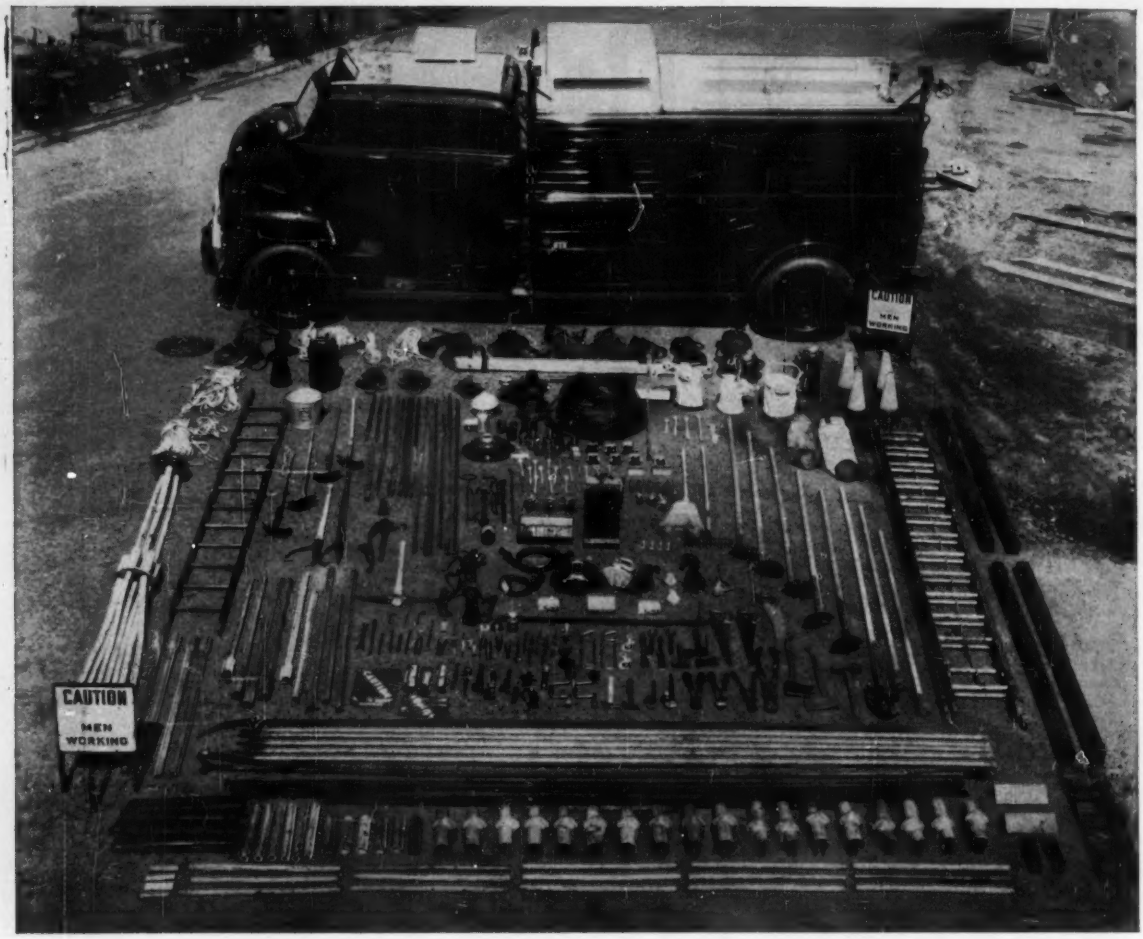
COMING NEXT WEEK—Electrical World will begin the new year with a modernized book. New features, added services, larger type will mark the big issue which will appear every week.



Look at your line truck equipment needs from this angle . . .

Here's a poles-eye view of a typical utility line truck showing the wide variety of construction and maintenance tools and safety equipment your linesmen need for most day-to-day jobs. But—without exception—each and every item shown can be ordered conveniently from your nearby Graybar office or warehouse . . . and in every case you get the type and quality needed to assure speed and efficiency on the job *plus* long years of satisfactory service. All are products your linesmen know and respect—products that have been tried, tested and proven in the field by scores of companies just like your own.

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IN OVER 130 PRINCIPAL CITIES

More Cost Reduction—
More New Business Promotion Needed

"So far as prosperity in the U. S.A. for 1957 is concerned, it's in the bag—if the enterprise of blowing up the world with atomic devices is postponed. It will be harder than ever to get rooms in Washington during the coming year because government will play a larger part than it has this year in maintaining the forward thrust of business. But between government, farmers who will be more prosperous than they have been for quite a few years, and business enterprise with a great deal of bounce left in it, prosperity will be maintained, and at a very lush level."

These are the words of Dexter M. Keezer, Director of our Economics Department in prophesying the business environment for 1957.

For the electrical industry we have evidence that this optimism is on the conservative side . . . early reports indicating that capital expenditures by electric utilities will be more than 25% over 1956. We also expect 1957 to provide the largest gain in residential use seen to date, going up from about 2,990 kwhr per customer to 3,250 kwhr per customer. As a whole the growth in use of electrical energy did not make records in 1956, and 1957 appears to hold even less in the way of increased use.

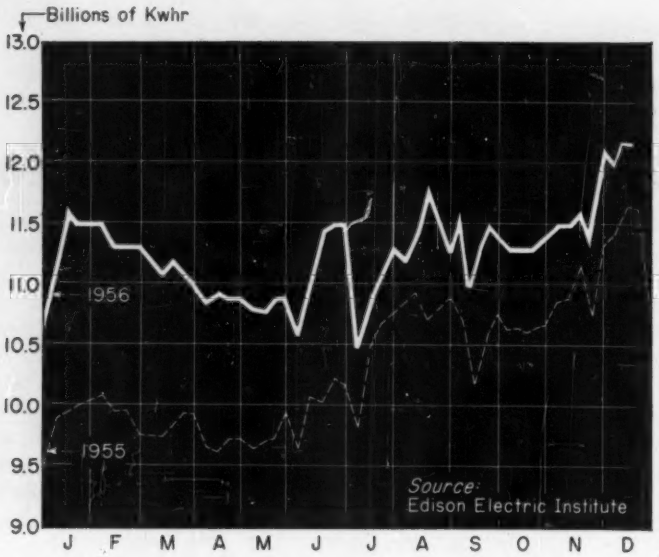
The striking thing about current developments in the electric utility field is the type of load growth rather than the extent. We have just passed through a period of substantial gains provided by the Atomic Energy program and the increase in industrial production at a very rapid rate. We have also seen the beginning of a drastic change in utility loads in the way of air conditioning and space heating which puts an entirely new dimension into the requirements for load-carrying equipment. These new requirements are brought about by the extra demands on the electric system during the summer months requiring much more conservative design of cable systems; the appearance of sharp, sometimes unexpected, summer peaks requiring larger reserves of generating and interconnection capacity; and much heavier load growth in residential areas necessitating high capital expenditures per killowatt of load added.

The substantial increase in capital spending which the new conditions create, and the higher cost of financing are placing new and heavier burdens on management, testing its ingenuity in many fields.

Over the past few years the utility industry has done a magnificent job in saving manpower in the generating plant, the accounting department, and in other areas. It is obvious that these trends will continue, but it is also obvious that something more must be done if the cost of electric service is not to turn up sharply in the years ahead. We believe that the opportunity to promote wider use of electricity in all areas of industrial, commercial, and residential activity is still the most prudent objective for the industry. We find in the industrial field that the truism "Grow or Die" proves to be highly accurate. Of course this is not true of the electrical utilities, but it has implications which should not be ignored.

We hope that in the year ahead we will see more striking developments in the fields of cost reduction and new business promotion to further strengthen this great industry.

ELECTRICAL WEEK



OUTPUT

Week ended Dec. 22, 12,225,000,000 Kwhr Up 5.3%*

* Estimated, data late because of holiday.

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Dec. 22	Not available because of holiday									
Dec. 15	+5.3	+4.8	+3.4	+4.8	+8.6	+2.0	+11.6	+9.4	+7.7	+9.7
Dec. 8	+5.4	+4.1	+2.2	+4.0	+7.5	+3.4	+12.4	+9.3	+10.7	+9.8

Here are the issue's highlights . . . There's a good year ahead for business in general, and General Electric Co and Westinghouse Electric Corp in particular. NEMA predicts sales of electric appliances will make steady gains in low-saturation areas. EEI looks ahead and sees generation totaling 750 million kwhr in '57, with the industry adding more than 110 million kw net capability in next decade. Several nuclear power plant projects may be revealed "in the near future," too, says EEI . . . American Public Power Association urges vigorous public-private development of atom power . . . "Brainstorming session" produces some ideas for cutting insulator damage during hunting season . . . Senator Gore is starting machinery to grind out another federal atom program . . . College students turn out substation designs for Consumers Power Co . . . Belgian Schelle power station burns oil refinery fuels that are stiff asphaltic tars at 60F. Fuel is delivered in insulated barges.

City of Memphis, Tenn., can pay high interest rates on its proposed power plant and still keep low power rates, asserts Major Thomas H. Allen, president, Memphis Light, Gas, & Water Commission. "We will stay in line with the low rates of the Tennessee Valley Authority power service area unless there should be a drastic falling off in demand for power," said Allen in commenting on the 4.4705% interest rate Memphis will pay on the $163 million in bonds issued recently.

It's up to New York Gov Averell Harriman to decide whether to approve contracts for sale of St. Lawrence power already negotiated by the Power Authority of the State of New York. Of the 750,000 kw of capacity to be available from the project, the Authority has contracted to assign 239,000 kw to Aluminum Co of America and 239,000 kw to Reynolds Metals Co. Earlier it had contracted to make available 115,000 kw of firm power and any interruptible available to Niagara Mohawk Power Corp. Harriman's two appointees on the five-man Authority voted against each of the proposed contracts.

Washington Wire . . . Federal Power Commission has denied three petitions for rehearing of its Oct. 24 order directing South Carolina Generating Co to reduce its electric power rates to Georgia Power Co by $252,186 a year. Petitioners were SCG, Georgia and South Carolina public service commissions.

Atomic Energy Commission reports microscopic cracking in the leak detector system of the homogeneous reactor experiment No. 2 at Oak Ridge National Laboratory. There is evidence of similar damage, believed due to chloride ion contamination of stainless steel tubing, in flanges of high pressure system to which leak detector is connected. Start-up of reactor thus has been delayed until fall of 1957. Damage may delay progress of Westinghouse-Pennsylvania Power & Light project which is depending on HRE 2 for some experimental data for its proposed large-scale prototype project.

Electric utilities in Oregon have asked State Water Resources Board to help them obtain a fair share of power from federal hydro projects. The board was created by the 1955 legislature to work out a state policy on water resources.

Britain's National Coal Board plans acceleration of its underground gasification program by igniting unminable coal seams to obtain gas. The program to increase the nation's fuel supplies, sped up by the Middle East oil crisis, includes construction by Central Electricity Authority of a 5-Mw generating pilot plant for 1958 operation. If successful, CEA may build a 60-Mw plant.

Contrary to a recent Federal Civil Defense Administration report, although six Midwestern electric power companies did witness tests, they did not "generally approve" a new internal warning system to send controlled 120-cycle signals over distribution lines into homes and offices to trigger an alarm receiver in event of attack. Two such systems are under development. One was tested this month. The other, a 540-cycle system, is pending test.

Congratulations . . . Glenn B. Warren, vice president of GE, has been named consulting engineer-Turbine Division. His former post of general manager of the Turbine Division is now being assumed by Vice President William S. Ginn.

ABOUT PEOPLE IN THE INDUSTRY

"PRDC is a non-profit company . . . organized primarily for experimental and developmental purposes," declared **Ernest R. Acker,** Central Hudson G&E president and PRDC vice president, at recent Securities & Exchange Commission hearing on PRDC's application for exemption under Public Utility Holding Company Act. He said Enrico Fermi A-power plant, planned construction near Monroe, Mich., "will be a gigantic test tube."

Power output of existing federal dams in the Columbia River system "will be completely pre-empted by preference customers" in future years, Pacific P&L Pres **Paul B. McKee** told Interior Secy Fred A. Seaton. McKee and other Pacific Northwest utility executives recently met with Seaton in an attempt to forestall government intervention on Snake River where the utilities plan hydroelectric dams at Mountain Sheep and Pleasant Valley.

More News About People page 40

There's a Good Year Ahead . . .

. . . for General Electric

• Company will go into 1957 with bigger backlog of orders than 1956. This year's sales will top last year's record by 18%, but earnings will lag a little

RALPH J. CORDINER

Next year will be good for the economy generally, and for General Electric, GE's Pres Ralph J. Cordiner predicts. High levels of business and employment justify expectations that the economy will set new records in 1957.

General Electric will go into 1957 with a bigger backlog of orders than in 1956, Cordiner said. The year now ending has been a banner one for capital expenditures, and much of it will spill over into 1957.

"We do not agree with those who express concern over the possibility of a recession in the latter part of the year," he said.

Moreover, Cordiner saw little chance that the current tight steel supply, or prospects of an accelerated tanker-building program, would affect shipment of electrical apparatus next year short of an across-the-board curtailment program.

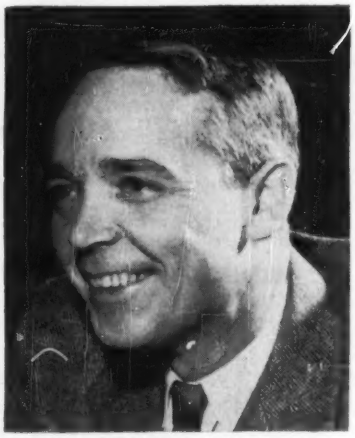
Prospects are that General Electric Co will finish 1956 with sales for the year totaling $4 billion—18% higher than the company's 1955 record of $3,463 million. But Cordiner said at his year-end press conference that earnings, although up 5%, have not risen as fast as sales. Mainly, he said, this is because company products are under-priced.

Turning to the 1957 prospects of the whole electrical industry, Cordiner observed that electrical manufacturing is running at a $21-billion level, and may climb 4 to 5% next year. The heavy power apparatus business may possibly double that gain.

Looking ahead, he predicted that today's Gross National Product of $411 billion will reach $[illegible] billion by 1976. Although the economy generally may double in 20 years, Cordiner predicted that the electrical manufacturing industry will increase

. . . for Westinghouse

• Unfilled orders are up 40%, but 1956 sales will beat 1955 sales. Three new plants coming, and stable labor. But Price sees stiffer competition next year



GWILYM A. PRICE

Sales in 1957 are expected to crack old records, predicts Gwilym A. Price, president of Westinghouse Electric Corp, in his year-end statement.

He said his company's business next year will push ahead because of vigorous planning, programming, and promotion in 1956. And it will ride on the crest of a business boom predicted to be even better in 1957 than in 1956.

Westinghouse will roll into the new year with a 40% increase in its unfilled orders, even though 1956 sales will top 1955 sales. And it is expected that orders booked in 1956 will exceed the previous high for new orders which was set during the "Korean buildup" in 1951.

Westinghouse will meet the future with more plants. At least one plant will initiate production in 1957—it is at Athens, Ga., and will make distribution transformers. Two more plants now are being built— one at Bloomington, Ind., for manufacture of switchgear distribution apparatus, and one at Dover, N. J., for manufacture of electric stairways.

The company will have a more stable labor situation, too, for contracts signed in 1956 with four major unions run through 1960. During 1956, Westinghouse employment hit a new high of 127,796 persons. Price said morale has been "excellent" since the strikes. Employees are cooperating in the post-strike programs. Manpower losses, due to the strikes, were less than 5% for all employees, and only ½% among engineers and research personnel. This turnover was lower than normal.

So Westinghouse is looking ahead to a good year. But for business as a whole, Price foresees stiffer competition, particularly for the consumer dollar, and rising costs that can be expected to squeeze earnings and place a premium on more-efficient production methods, cost reduction, and inventory control. "In addition," he said, "the tight money supply may hamper some businesses."

"To meet rising costs and increased competition, Westinghouse placed renewed emphasis on reduction of manufacturing costs during 1956. Improved methods, and revised plant

its sales by 4 to 4½ times.

In 1955 General Electric spent $158 million for modernization and expansion of plants and facilities. In the three years 1956-1958, inclusive, the company will invest $500 million additional and perhaps more, Cordiner said.

"Tight money has not backed us off," he said. "We are planning for the longer future."

In 1956 GE's 280,000 employees in the U. S. and Canada have gotten about $1.5 billion in pay and benefits applicable to sales. This is an all-time high in employee compensation, Cordiner noted. Also during the year, GE stockholders received dividends totaling $2.00 a share, highest dividend GE has paid.

In the first 9 months of 1956, GE appliance lines led other products in dollar volume of profits, and equalled other lines in profit on a percentage basis. In commenting on future development of electric appliances for the home, Cordiner said that the next decade will see many household tasks —done now with electricity—being done with electronics.

layouts were made and are scheduled to be made," Price said.

The company's board of directors late in 1956 authorized adoption of the LIFO (Last In, First Out) method of valuing inventories to help curb costs. This system eliminates inflation in inventory costs and charges inflation to operations. Although this reduces reported profits, it increases cash earnings during periods of rising costs, he said.

For Westinghouse, booming industrial activity in 1956 reflected itself partly in a 50% increase in backlogs of products awaiting production by the apparatus division.

Index Coming Up

Electrical World's semi-annual index for July-December 1956 is now being prepared for inclusion in one of the January issues.

Appliance Outlook: From Good to Better

Sales of electric appliances in 1957 will continue to gain on low-saturation items while staple devices remain close to 1956 totals. This is National Electrical Manufacturers Association's outlook for the coming year.

Dishwashers will make best percentage gain. NEMA predicts 475,000 sales, or an 18.7% gain over 1956.

Trend to built-in ranges will continue. Sales in 1956 jumped to 385,000 units for 92.5% increase over '55. Next year, volume will be 425,000 sales, or a 10.4% gain. Standard range sales dipped 200,000 in '56 to a 1.2-million total, a figure which NEMA foresees again in 1957. This is a 14.3% drop under 1955. Combined built-in and standard range estimate—1,625,000 units—represents a 2.5% 1957 increase.

Food disposers will chalk up another good gain. Sales in '57 will hit 650,000, a 10.2% jump over the previous period. Dehumidifiers volume is estimated at 300,000 units compared with 275,000 for 1956.

Staple items dropped 3 to 15% in 1956. In 1957, they'll show these gains: Refrigerators, 3.9-million sales, a 5.4% increase; freezers, 1-million, 2.6%; water heaters, 900,000, 3.4%.

APPA Blueprints Industry Atom Plan

A program to develop economical atomic power through cooperation of all segments of government and industry was urged in a statement by the American Public Power Association.

Stressing the government's role in the rapid development of a successful atomic power plant program, Pres William S. Peterson said, "Federal policies should encourage the growth of a vigorously competitive atomic power equipment industry" to attain "really low-cost atomic power."

"We do not believe . . . the whole job should be done by the federal government," said Peterson, "but obviously the nature of federal policies will affect very greatly the rate at which economically practical atomic power is achieved in this country, and the conditions under which the atomic power industry will operate."

The statement also urged that national policy recognize and encourage the contributions each segment—state and local governments, industry, consumer and privately owned electric utilities, and institutions of higher learning and research—can make "towards the national objective of maximum progress in the peaceful applications of atomic energy."

APPA's statement proposed that:

• Consumer and publicly owned utilities construct demonstration power plants, with federal financial assistance where necessary.

WILLIAM S. PETERSON

• Demonstration plants be constructed by federal agencies "until technology is favorable to vigorous and general . . . construction and operation on a commercial basis."

• Federal policies should "encourage free competition, avoid monopoly, and provide no subsidies or special assistance to selected organizations" unless the benefits accrued are made available to all.

• Atomic power plants be developed to suit the needs of small, as well as large, utility systems.

• Technical information gathered from federal atomic power programs be disseminated as widely as possible.

DONALD S. KENNEDY

EEI Looks Beyond 1956 And Sees:

- Generation will total three-quarters of a trillion kwhrs in 1957.
- The industry will add more than 110 million kw of net generating capability in decade ahead.
- In 1959 a gross margin of 20% between generating capability and peak demand—up from 15% this year.
- An average yearly construction expenditure of $4 billion by companies over next decade.
- Announcement of several new nuclear power plant projects in the near future.

EEI Pres Kennedy Reviews Year's Gains

The electric utility industry in 1956 continued to set records in production, sales, number of customers, average use per customer, and in other fields, Pres Donald S. Kennedy reported in the annual Edison Electric Institute year-end statement.

Here are the highlights:

GENERATION

To serve the domestic, industrial, defense, and commercial needs of the 168 million people in the nation, the electric utilities generated 601 billion kwhr of electricity in 1956. This was 54 billion kwhr greater than in 1955—double that of 1949 and triple that of 1942. Added to the 1956 utility generation was 84 billion kwhr produced by industrial and railway generating plants, bringing the grand national total production to 685 billion kwhr for the year.

CAPABILITY

Installed capability of the electric industry at the end of 1956 totaled 126.5 million kw—an increase of 6.7 million kw over 1955. The 76 million kw installed during the past ten years adds up to a 152% increase over 1946. Gross margin between generating capability and peak demand in 1956 was down to 16,500,000 kw, an average of 15% of total installation for the country as a whole, as compared with 17.9% for 1955.

Of the approximately 43 million kw of generating capability already scheduled for 1957 and beyond, 35 million including more than one million kw in atomic power plants, is planned for installation by the investor-owned companies. Eight million is scheduled by federal and other public agencies.

ATOMIC POWER

At the end of 1956 some 49 electric power companies and associated service organizations were taking part in projects for the development and construction of 11 atomic power plants. Eight of these will have capacities of from 60,000 to 236,000 kw. One large and two small ones are to be in operation by 1958; three more large ones by 1960 and four large and one of a size not yet determined after 1960. The 11 plants with a total ultimate capability of over 1.3 million kw will cost an estimated $350 million by power companies.

ELECTRICITY SALES

Total electricity sales reached 529 billion kwhr in 1956—up 10% from 1955. Industrial sales reached 274.4 billion kwhrs—up 10.1% from the previous year. Residential sales climbed to 133.8 billion kwhr—up 11%, and commercial sales hit 88.4 billion kwhr—up 9.4%. Sales to other users totalled 32.4 billion kwhr.

CUSTOMERS AND USE

Utility customers at the end of 1956 totalled 54 million—an increase of 1,440,000 over 1955. In the past ten years, residential customers increased by 16,000,000 or more than 50% and commercial and industrial by 1,557,000 or 32%. Use of electricity by residential customers in the nation averaged 2,980 kwhr in 1956—an increase of 229 kwhr over the 1955 average and the highest annual increase on record.

INVESTMENT AND CONSTRUCTION

Investment in electric plant and property of electric companies at the end of 1956 stood at $33 billion. Expenditures for construction of generating, transmission, distribution, and miscellaneous facilities by electric companies totaled approximately $2.9 billion during the year—with an average of $2.3 billion per year over the past decade.

REVENUE AND EXPENSES

Gross electric revenue for electric companies amounted to $7,535,000,000 in 1956—up 8.7% over the previous year. On the other side of the ledger, taxes consumed $1,790,000,000 (23.8%) of the revenues. Wages and salaries took $1,330,000,000 of the 1956 revenues—up 5.1% over the previous year. Fuel, third highest item in the expense account, cost $1,235,000,000 during the year, an increase of 11.9% over 1955.

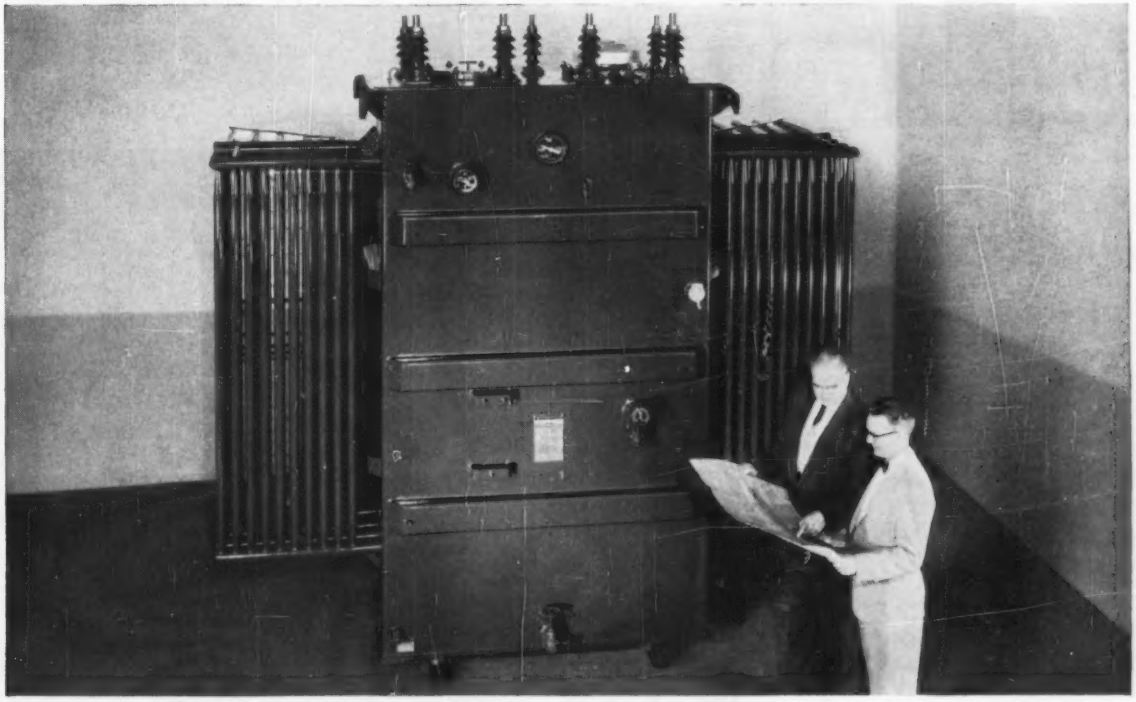
GENERATING EFFICIENCIES

Average fuel conversion efficiency of steam-electric generating plants is constantly increasing. In 1946, 1.29 lb coal were required to produce a kwhr of electricity. In 1956, the figure was down to 0.93 of a pound—a reduction of 28%. One plant now under construction is expected to use only three-fifths of a pound of coal per kwhr of generation.

Design time... five minutes

WESTINGHOUSE ENGINEERS are now designing mathematically perfect power transformers with new IBM-705 electronic computers . . . in minutes.

J. C. Rissinger, Manager Substation Equipment Sales, reviews design improvements with Gordon Monroe, Section Mgr., Engineering Department . . . many made possible by freeing engineers from routine design calculations.



Automation has come to transformer design. Two new Westinghouse computers telescope design time to just short of nothing. That's important because designing a well-balanced transformer has been a complex and time-consuming job. Now, such factors as impedance, losses, sound level, temperature rise and dielectric strength are all integrated into product design—automatically, literally in 5 minutes.

The exclusive application of this Westinghouse pioneered innovation to the complete design of power transformers means products of mathematically perfect quality.

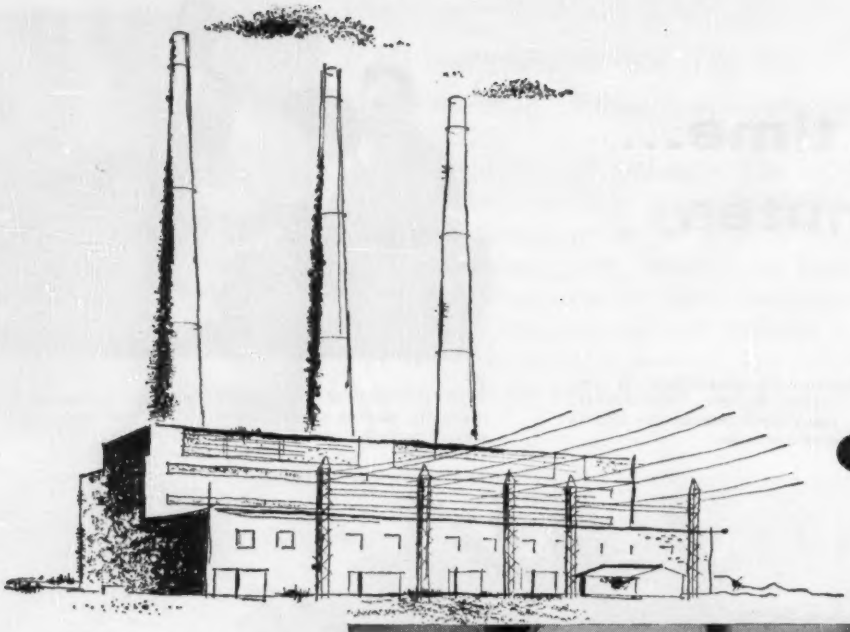
Specification and purchasing are simpler. Exact design information is right on hand at the time the order is negotiated. Eliminating 99% of our design time means you get faster delivery.

The time of, literally, dozens of engineers is being made available for creative development work on new and better transformers. Even when product performance already represents industry leadership, you can depend on Westinghouse to introduce new ideas that make any Westinghouse transformer a better buy.

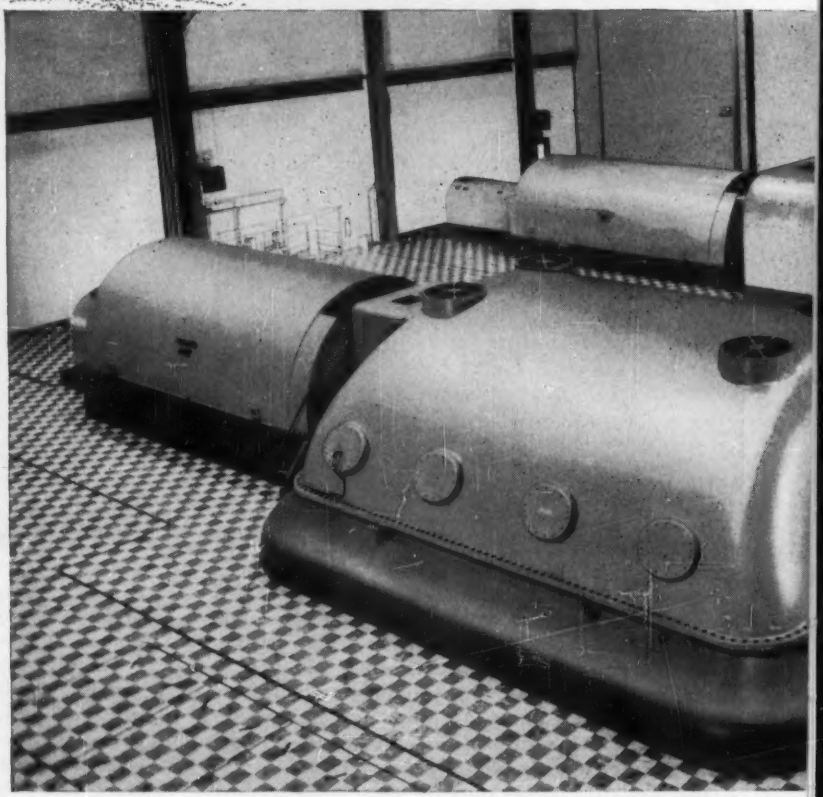
Get in touch with your Westinghouse sales engineer, today, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-70767-X

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***



OVEC's

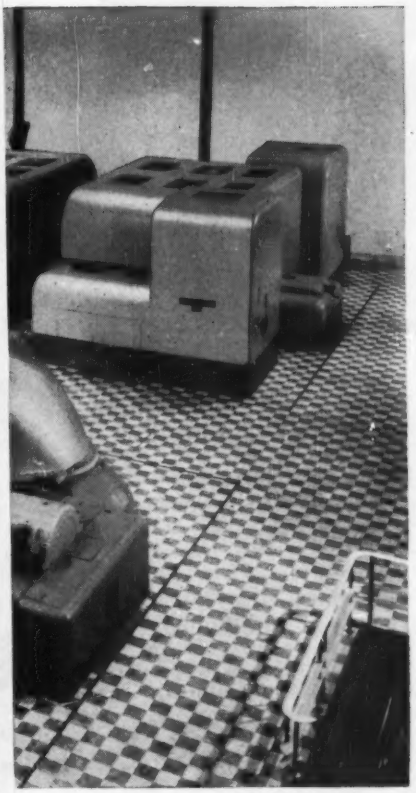


OVEC IS OWNED BY THE FOLLOWING PRIVATE ELECTRIC UTILITIES:

Appalachian Electric Power Company* • The Cincinnati Gas & Electric Company
Columbus and Southern Ohio Electric Company • The Dayton Power and Light Company
Indiana & Michigan Electric Company* • Kentucky Utilities Company
Louisville Gas and Electric Company • Monongahela Power Company** • Ohio Edison Company
Ohio Power Company* • Pennsylvania Power Company*** • The Potomac Edison Company**
Southern Indiana Gas and Electric Company • The Toledo Edison Company • West Penn Power Company**

*Subsidiary of American Gas and Electric Co. **Subsidiary of The West Penn Electric Co. ***Subsidiary of Ohio Edison Co.

Kyger Creek Station



...best heat rate in the nation for 1955!

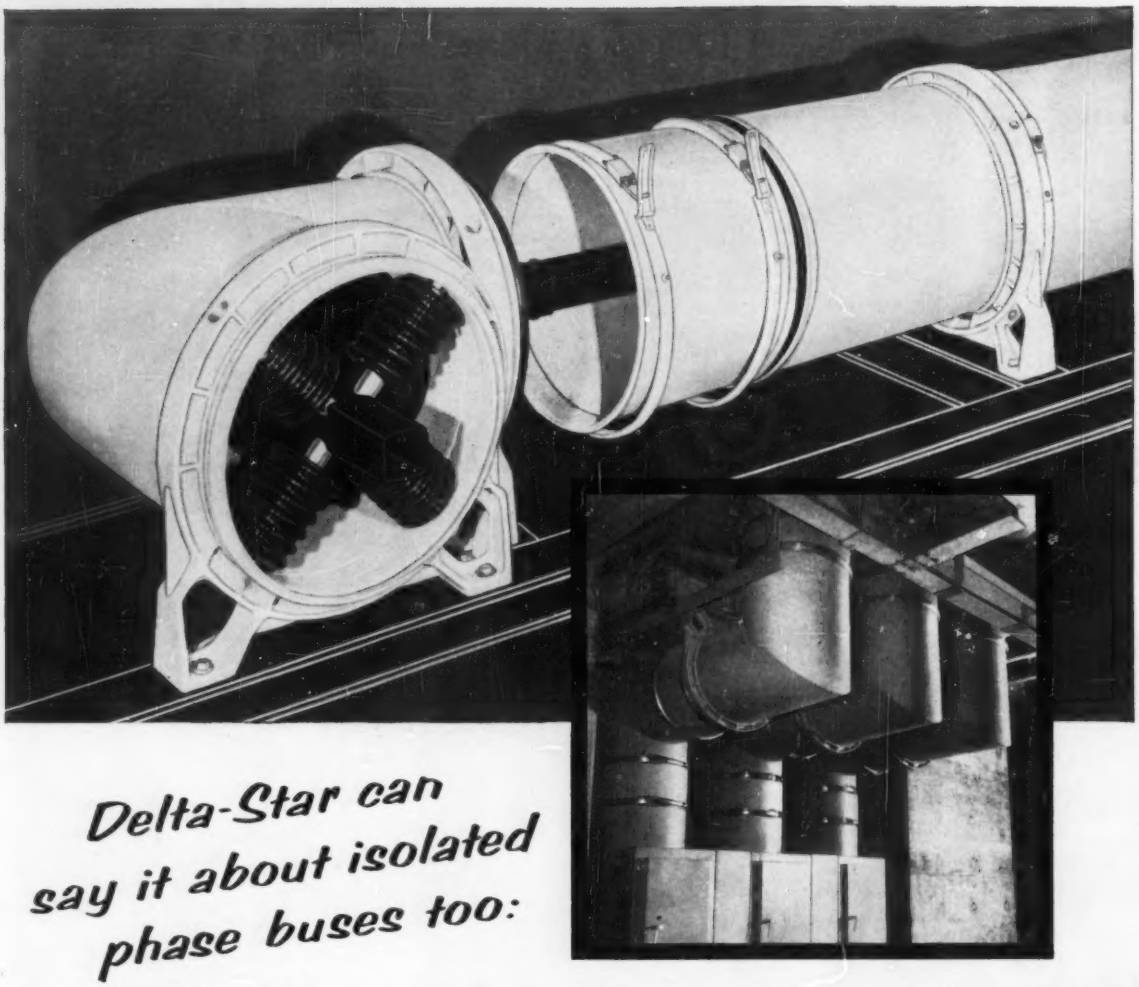
In the fast-moving race to higher and higher station efficiencies, Kyger Creek Plant of the Ohio Valley Electric Corporation placed first for the year 1955 according to figures released by the Federal Power Commission. The official rate was 9110 btu/kwhr.

Four of the five Kyger Creek turbine-generators are Westinghouse cross compound, double flow, rated 217,260 kw.

J-50591

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***



Delta-Star can say it about isolated phase buses too:

original or similar...which do you prefer?

"Imitation is the most sincere form of flattery!" When Delta-Star introduced the new isolated phase bus with telescoping covers, its time-and-money-saving value was immediately recognized by utility engineers and by the fact that similar buses were soon introduced in the market.

Delta-Star's original telescoping-cover bus is quick, easy, and economical to install. Covers are an integral part of the enclosure—no bolts needed, no covers to lift, and no longitudinal gaskets to install.

Quick access reduces bus inspection and maintenance time. Easily operated clamping rings lock and seal enclosure against dust and moisture.

Similarities help prove the exceptional value of the original.

If you are not fully acquainted with the exclusive features and advantages of Delta-Star "originals," check with your nearby Delta-Star representative soon.

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

2437 Fulton Street · Chicago 12, Illinois · District offices in principal cities

The Fuse Is Sputtering

Sen. Albert Gore (D-Tenn.) has lit the fuse on what promises to be another explosive issue in Congress. He has written letters to leaders of both houses, and to Democratic members of the Joint Committee on Atomic Energy to seek their help in speeding up the U. S. atomic power reactor program.

Whether the U. S. will lead the world in this field depends, he believes, on whether the U. S. perfects various types of nuclear reactors. "Unless we maintain our leadership in this field," he said, "we lose many advantages, plus a lot of world business for our atomic industry." He reminded legislators that Japan is now negotiating with England—not the U. S.—for a large-scale power plant. (U. S. manufacturers are said to have proposed small jobs.)

Hot upon the heels of Sen Gore's letter came word that the U. S. has landed its first big export order for a nuclear reactor. Edisonvolta SpA, Milan, Italy, will buy a 134-Mw pressurized water reactor from Westinghouse International, to be operating "shortly after" Yankee Atomic Electric Co installs a similar reactor in 1960. Italians placed another reactor order in the U. S. last week when they signed a contract with ACF Industries Inc., for a CP-5 heavy-water, 5-Mw research reactor. This reactor is to be in operation in 1958 for the Comitato Nazionale Richerche Nucleari of Italy.

Meanwhile, a survey conducted by Raytheon Manufacturing Co led to this prediction for 1960: Britain will lead the U. S. in production of atomic power, but the U. S. will be the world leader in the field of nuclear reactors for research, testing, and experimentation.

Up for Citation . . .

Pacific Power & Light Co is now eligible for the National Safety Council's coveted merit award and a similar citation from Edison Electric Institute. Reason: It has chalked up 1,000,000 man hours of work without a single lost-time injury. Scattered over its five-state service area, 60% of the company's 2,542 employees hold jobs which entail risks of accidents.

Fight for Proxies

J. Raymond Dyer, a St. Louis attorney, has filed suit against Union Electric Co on behalf of his daughter Nancy who hopes to bring about the election of a new board of directors to replace the company's present management.

Dyer charged that company officials refused him access to stock books and records. The petition says that Miss Dyer, a 20-year-old Bryn Mawr student who bought 100 common shares in April, wants a stockholder list so she can solicit proxies for the threatened fight. It asked for use of the company's 54,000 stockholder addressing plates. It is not clear to observers who would pay the $1,620 postage bill. The suit further seeks $750 damages for "deceptive" newspaper ads which stated the management's position relating to the fee Union Electric paid a legislative agent (EW, Dec. 3, p 15).

Union Electric had no comment on the suit.

Working Hard

Four generators at Hungry Horse power plant are running 'round the clock under a 14% overload to supply Pacific Northwest industries with "provisional" power. The 285-Mw plant now produces 325 Mw with four generators rated at 71,250 kw. each. Under the agreement with 10 major users, provisional power must be paid back to Bonneville Power Administration if a later shortage makes it necessary. It must be paid back on a cost basis of 1.67 to 1. Thus, some northwest industries are gambling that 1957 will be a wet year.

Provisional hydro power can be paid back through purchase of steam power. Or the companies can give up some of their rights under firm power contracts. This provisional power is generated by drawing down Grand Coulee and Hungary Horse reservoirs. It must be repaid to Bonneville only if the reservoirs do not fill up again to the proper levels.

Load Shifting Here & There

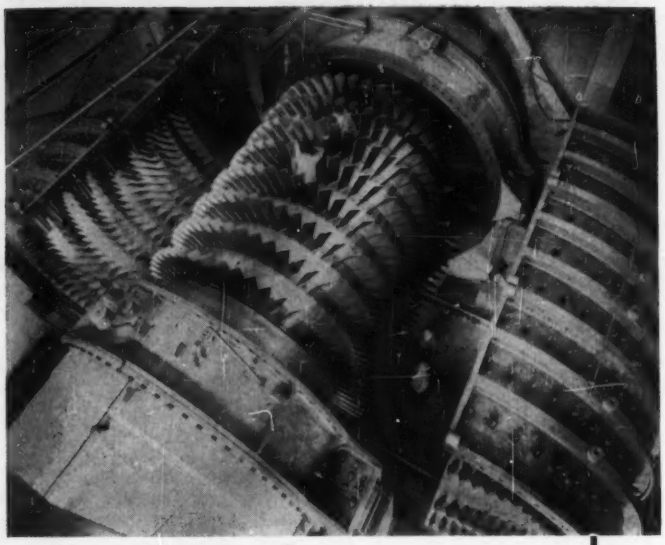
The 5-year-old Union for Coordination of Production and Transmission of Electrical Energy (UCPTE) has laid a solid basis for close cooperation in the field of electrical economy between the six Schuman Plan countries and Austria and Switzerland. UCPTE mediates offers and requests for electricity, especially in cases where operational troubles, or difficulties in water or fuel supply, make necessary the supply of electricity from another country.

Electricity supplies over large distances are facilitated by load shifting. If power, for instance, is to be delivered to Belgium from Italy, transmission losses are reduced by using Italian electricity in Switzerland. North Germany, at the same time, reduces its power supply to South Germany and from there to Switzerland—so that part of the North German electricity supply is freed for Belgian consumption.

Crossing the Bar

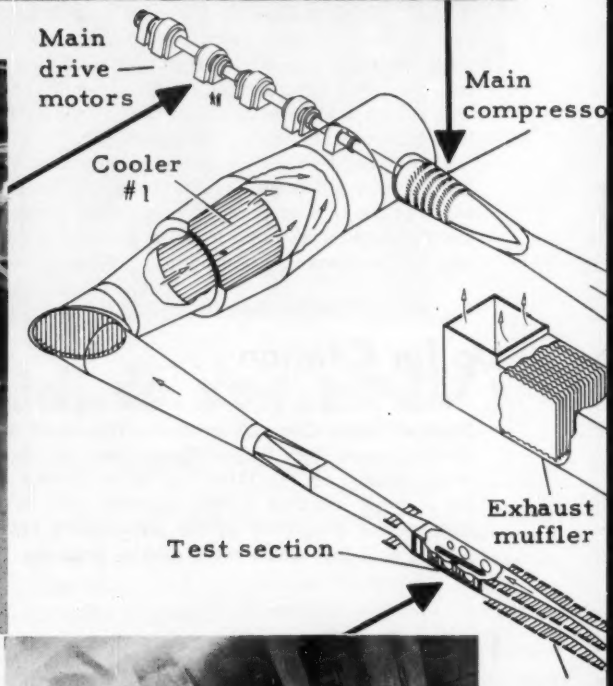
A Crooksville, Ohio, blue heron has "crossed the bar." His six-foot wingspan got him in trouble. He struck a 4,000-v power line, then brushed a 20,000-v line with a wing. All power within a half-mile radius failed. The carcass was exhibited in an Ohio Power Co window recently, but not as a recommendation on how to prepare the Christmas bird.

350-Mw Wind Tunnel

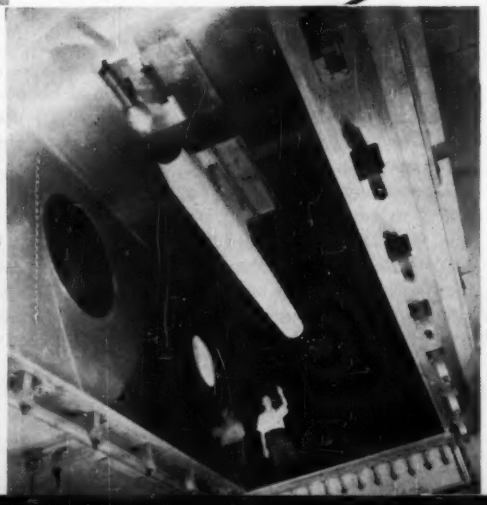


MAIN COMPRESSOR employs eight stages of 20-ft.-dia fans. Two compressors can push a ton of air per sec through the test section at 3½ times the speed of sound

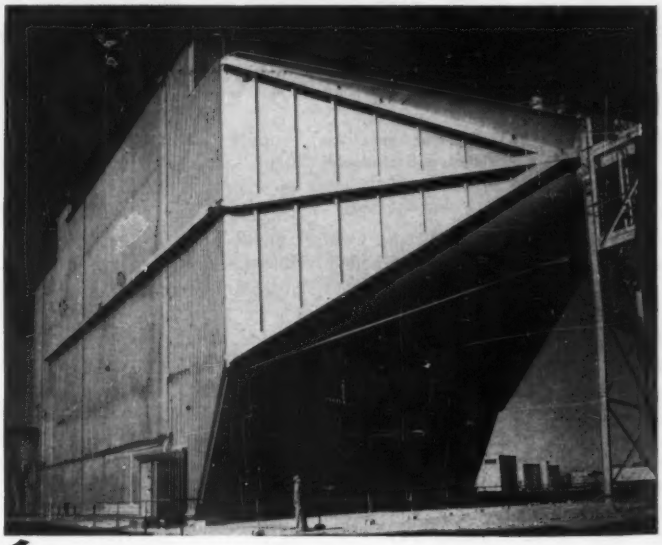
MAIN DRIVE consists of four 37,500-hp wound-rotor induction motors in tandem on one shaft. They must deliver constant torque between 80 and 100% of rated speed



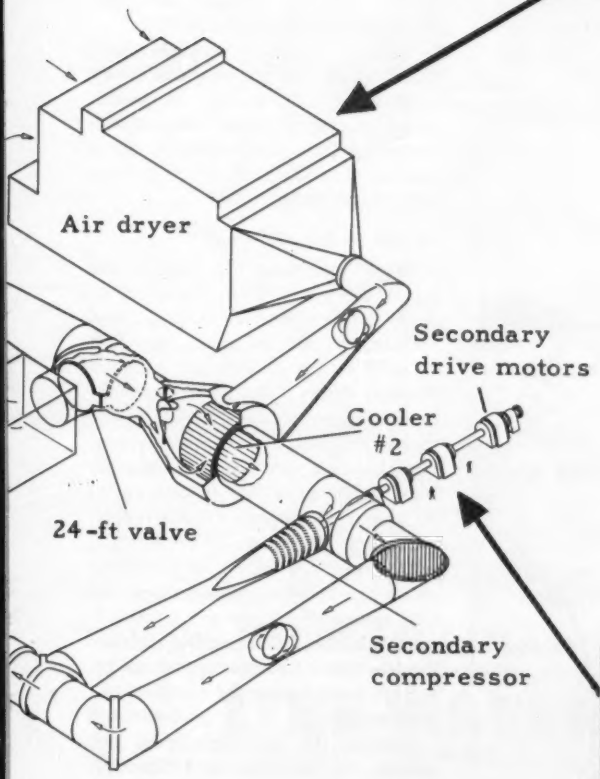
Focal point of this massive tunnel is 10x10x40-ft test section where air reaches supersonic speed; adjustment is by moving flexible walls of the nozzle immediately upstream



Fills Valley in CEI Load



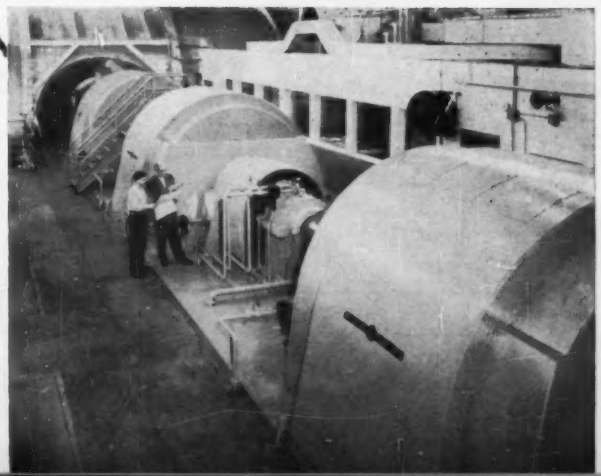
AIR DRYER uses 1,900 tons of activated alumina to remove 15,000 gal of water per hr from air drawn into the tunnel. The dry air enters the tunnel through duct at right



How CEI Supplies a 350-Mw Load
. . . page 18

How NACA's Wind Tunnel Operates
. . . page 22

How the Wind Tunnel Is Driven
. . . page 24



SECONDARY DRIVE supplements the main drive at speeds above 1,700 mph. These three wound-rotor induction motors furnish 100,000 hp for the secondary compressor

How CEI Supplies 350-Mw Load

Four 132-kv circuits supply the NACA lab; dispatching power for this load requires constant, close coordination

B. G. SCHIMANSKY, General Supervising Engineer, System Planning Engineering, Cleveland Electric Illuminating Co, Cleveland, Ohio

When the National Advisory Committee for Aeronautics proposed in 1950 to build the world's largest supersonic wind tunnel at its Lewis Flight Propulsion Laboratory at Cleveland, Ohio, the total NACA load was expected to reach 350,000 kw. This presented Cleveland Electric Illuminating Co with the double problem of supplying and dispatching power for NACA's load.

To supply the load, CEI decided to reinforce two existing 132-kv 4/0 copper circuits with two 132-kv circuits of 636,000 ACSR. When required by load growth the 4/0 copper circuits will be replaced with 636,000 ACSR. This ultimate installation will provide maximum capability in excess of 600,000 kw.

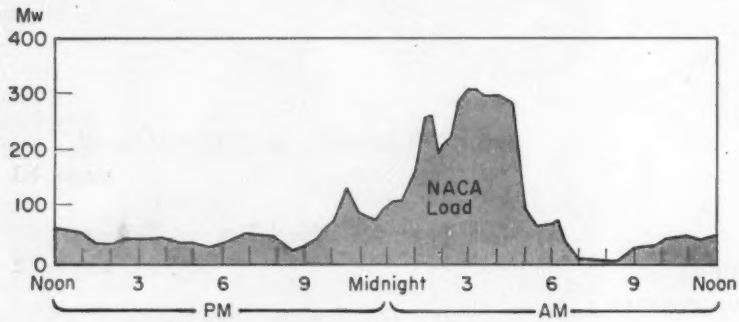
In 1939, when NACA first proposed to build a laboratory at Cleveland, CEI's facilities for supplying power to that area were rather meager. They consisted principally of 4,340-v distribution circuits and two 33-kv subtransmission circuits of somewhat limited capacity.

Although in 1939 future load growth was not too clear, the initial load of approximately 30,000 kva—small as it was in comparison to the present load—indicated the necessity for a supply of much greater capacity than was available in the area.

CEI decided to supply the load at 132 kv by tapping the Avon-Fowles transmission circuits about 3½ miles south of the proposed lab site. This was expanded so that, when the new wind tunnel was proposed in 1950, the supply consisted of two 132-kv circuits of 4/0 copper which had been extended east from the original tap point to Fowles substation. Then, to satisfy the requirements of the new wind tunnel, CEI added the two 132-kv circuits of 636,000 ACSR.

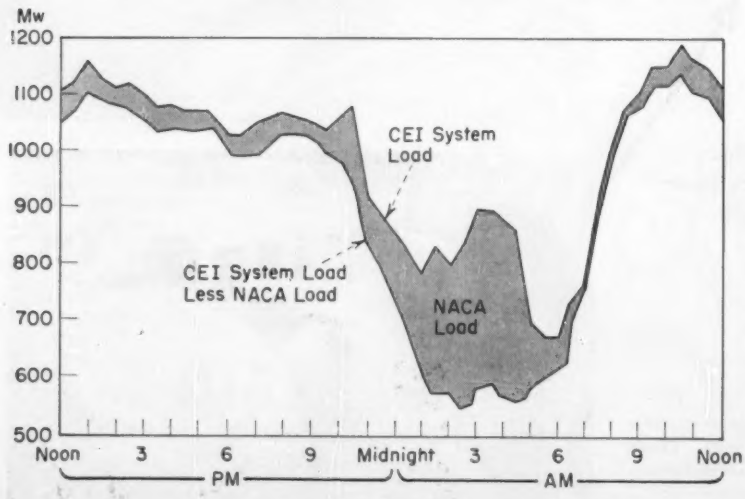
It was possible to load these circuits effectively without 132-kv bussing. This permitted reasonable short-circuit duties and made possible the continued use of existing breakers.

Further growth of the laboratory facilities can be handled readily by CEI's tightly knit metropolitan system. Avon generating station, only 24 circuit miles from the laboratory, has a capacity of 420 Mw and will have 670 Mw in 1958.



NACA load soars after midnight . . .

. . . and fills CEI's system off-peak valley



Tunnel Is Run Off-Peak

Daily operations at NACA are based on an on-peak limitation of 30 to 50 Mw between 7:00 am and 10:00 pm and off-peak operation from 10:00 pm to 7:00 am, Monday through Friday. During off-peak operation the giant wind tunnel can be run at full capacity. On-peak operation, however, provides only for the other facilities at the laboratory as 50 Mw is not enough for the tunnel.

During the on-peak period the NACA operator may request power above the 50-Mw limitation and the CEI system dispatcher will furnish it when available. This generally permits the laboratory to begin operations on a large scale before the specified off-peak period.

Because the laboratory does not operate on Saturdays and Sundays, its operation does not affect CEI's normal week-end maintenance.

The above chart of a typical day's operation shows how NACA picks up its load and coordinates with the CEI system. At 9:30 pm the lab started to pick up its load until it reached

(*Continued on page* 22)

TRIPLE-TESTED
To Assure Top Quality

High-Voltage Pin-Type Insulator. This and all other Illinois insulators are available with radio and TV noise-proof glaze in standard production.

At Illinois Electric Porcelain Co. the manufacture of electric porcelain is no longer an art or simply a skilled craft. New standards of material testing, manufacturing controls, and rigid final tests have made porcelain manufacturing a scientific production procedure.

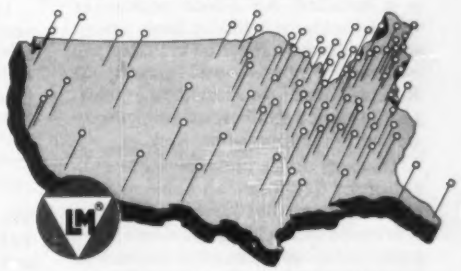
By triple-testing as set up by Illinois, we mean: (1) incoming materials are tested in a new, complete ceramics laboratory; (2) quality control during manufacturing assures uniformity and compliance with high standards in molding, pressing, drying, glazing, and firing processes; (3) rigid mechanical and electrical tests to destruction are made on a representative quantity of the finished product. The result is a product the user of Illinois porcelain can depend on for uniformity, consistently high strength and insulating value.

The high-voltage pin-type insulator shown is available in EEI-NEMA ratings 56-1, 2, 3, 4 for 23, 34.5, 46 and 55 kv with radio noise-proof glaze as standard.

Illinois Electric Porcelain products include pin and suspension insulators, strain insulators, switch and bus insulators, hardware and fittings.

For fast service, just pick up the phone now and call your nearest L-M office. Or ask your L-M Field Engineer for complete information and a copy of Bulletin DL8; or write Line Material Company, Milwaukee 1, Wisconsin.

67 L-M Warehouses... there's one near you!

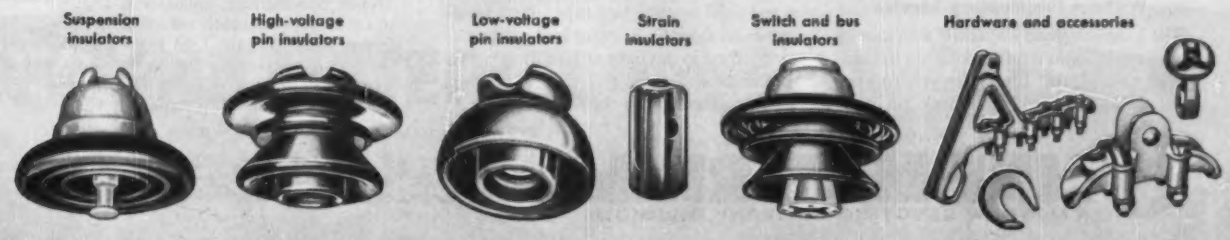


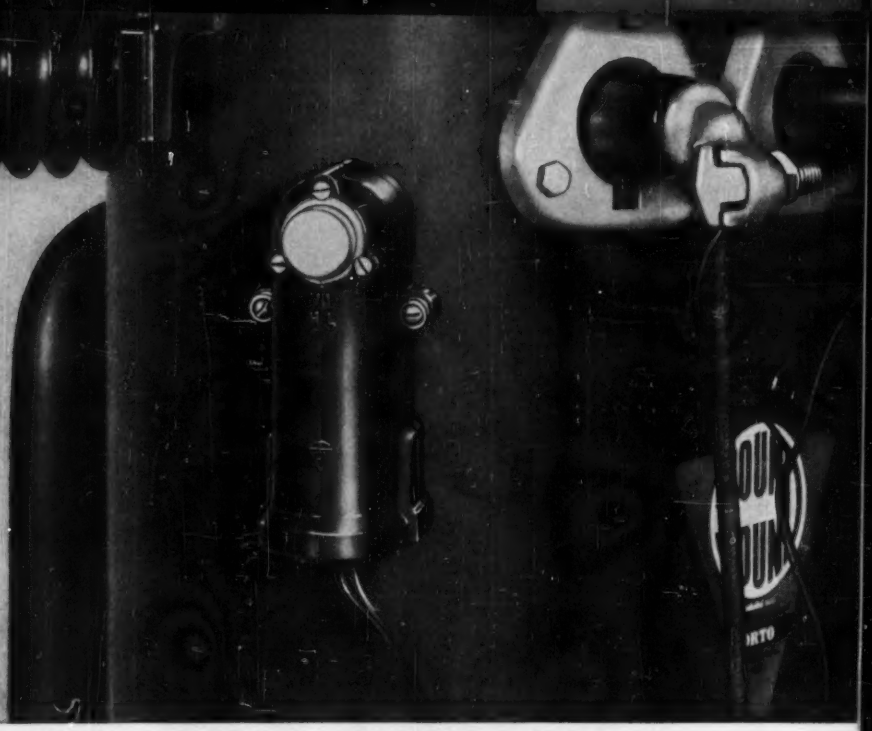
ILLINOIS ELECTRIC PORCELAIN COMPANY
(a McGraw Electric Company Subsidiary) Macomb, Illinois

Distributed by **LINE MATERIAL** *Electrical Porcelain Insulators*
A McGRAW ELECTRIC COMPANY DIVISION

285

L-M offers an extensive line of suspension and strain insulators, and hardware accessories





For mounting on transformers already in service, Alnico permanent magnet holds overload indicator on transformer tank. It will not creep or vibrate loose. The device provides an accurate yet economical overload indication.

New L-M Thermal Overload Indicator Easy To Install; Provides Constant Check

Simply attached and held by permanent magnet; provides continuous overload check; avoids service interruptions.

All you have to do is place the L-M thermal overload indicator against the transformer tank already in service, and it is installed. An Alnico permanent magnet holds the indicator firmly against the transformer tank. The indicator will not creep or vibrate loose. On new L-M Round-Wound® transformers the indicator is attached to a bracket permanently welded to the transformer tank.

This new device provides visible indication of overloads on conventional transformers up to 100 kva by means of a drop-down red light or drop-down luminescent tube. The luminescent type is provided with a nylon cord which can be attached to a cover bolt or other convenient projection to prevent the indicator from falling in the event the pole receives a severe shock.

Continuous Overload Check Without Interrupting Service

The L-M overload indicator provides an economical and reliable solution to load-study problems. It enables you to keep a continuous overload check on your distribution load and also eliminates the costly and laborious work required to take spot load checks.

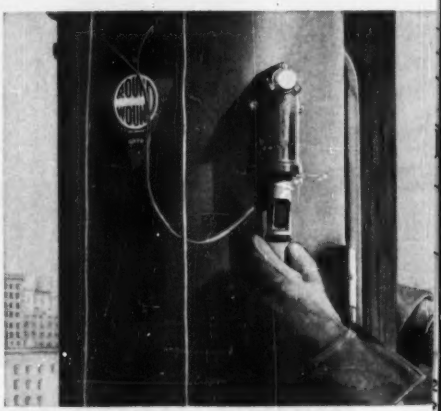
In addition, the indicator on a conventional transformer does not interrupt service. It serves as a tool to reduce transformer burnouts and maintain service continuity by indicating serious overloads before they can cause trouble.

Compensates For Ambient Temperatures

The overload indicator measures tank-wall temperature (a function of top oil and hot spot temperatures), and makes proper allowance in transformer loading for variations in ambient temperature. Accuracy is sufficient for all practical purposes.

Indication Easily Seen

The overload indicator is available with a red light or reflecting tape. Both types are exceptionally brilliant and easily distinguished in daylight as well as at night. Indicator with red light requires an electrical connection to the transformer.



Indicating target is easily seen during the day or night. It is quickly and easily reset by simply pushing the indicating tube up.

Get Complete Information

L-M overload indicators are available for mounting on transformers in service, with permanent magnet, or stainless steel wire to wrap around tank. On new L-M Round-Wound transformers, indicator is attached to a bracket permanently welded to the transformer tank. Ask the L-M Field Engineer for bulletins and complete information. Or write Line Material Company, Protective Equipment Division, Milwaukee 1, Wis.

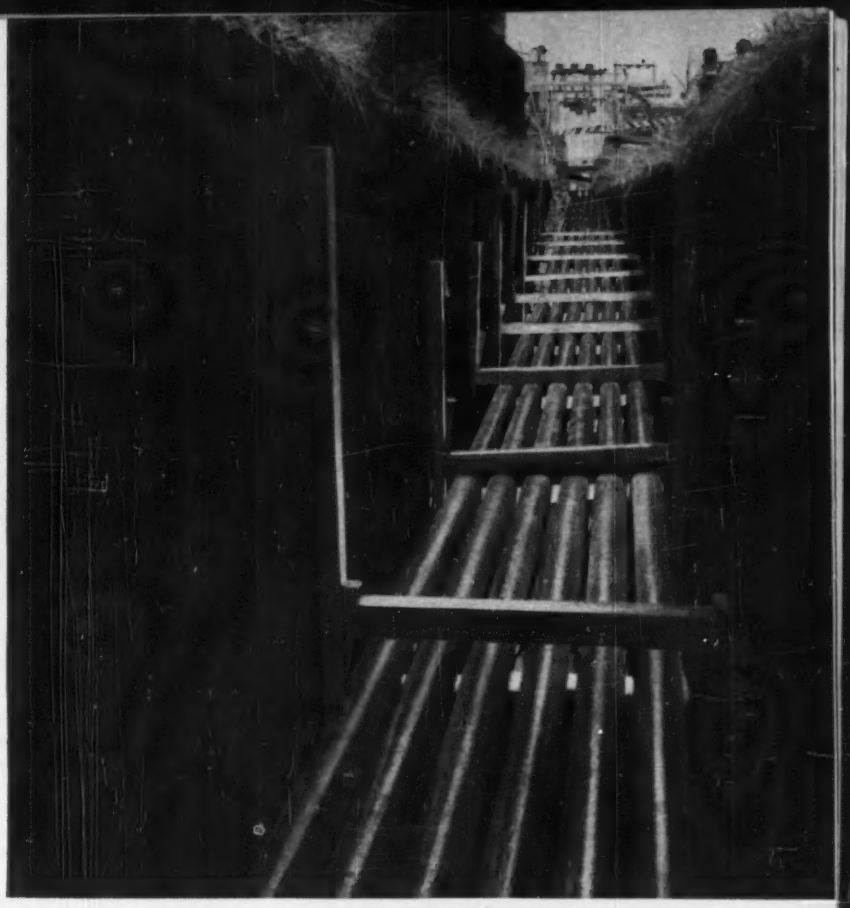
272-R

LINE MATERIAL *Protective Equipment*

A McGRAW ELECTRIC COMPANY DIVISION

L-M Permaline conduit can be shipped packaged in a sling. Here is a crane unloading 744 ft. of conduit at one time, saving hours of unloading time.

Lift truck is handling 512 ft. of conduit. L-M Permaline conduit is available on pallets to save handling. The time-saving is worth the slight additional cost.



L-M Permaline fibre conduit was used in 132 kv primary, 26.4 and 13.2 kv secondary duct runs for a large bulk substation. Permaline's smooth inner bore makes cable easy to pull, and reduces cable sheath abrasion.

Here's Why L-M's Permaline Conduit Is Easy To Handle, Easy To Install

Line Material makes it easy for you to handle Permaline fibre conduit in the material yard and on the job. For a slight additional cost, L-M packages the conduit in slings or on pallets for unloading in the material yard. This way large quantities of conduit can be unloaded in minutes with a crane or a lift truck. In the pictures above, a crane is unloading 744 ft. of conduit at one time, and the lift truck 512 ft. The next time you buy conduit, be sure to order L-M Permaline conduit in slings or on pallets and save hours of unloading time.

Permaline Is Laid Faster

L-M Permaline conduit also comes in long lengths. It is light, easy to handle on the job and in the trench. Joints are quickly and easily made by simply tapping the tapered couplings onto the tapered end of the conduit. Joints are watertight and safe from seepage of wet concrete and soil water. You'll find that Permaline conduit can be laid faster than many other types of duct.

Complete Line of Duct and Accessories

L-M Permaline conduit is available in 5-foot lengths, sizes 2, 4, 5, and 6 inches; also 8-foot lengths, sizes 3, 3½, 4, 4½, and 5 inches.

L-M has a complete line of accessories which include:

Spacers for any duct configuration.

Bends and angle couplings, including 5° angle couplings, S-bend, 45° and 90° bends.

Bell ends for use at conduit terminals.

Fibre caps to seal duct lines prior to drawing cable.

100% Salvage

L-M Permaline conduit can be cut with a hand saw. Smooth, precision tapers can be cut in the field with L-M's tapering tool, providing 100% salvage of field-cut ends.

Get Complete Information

L-M offers a completely engineered system for conduit installations. Ask the L-M Field Engineer for a copy of the 12-point plan folder, which shows how easy it is to use our system; or for Bulletin UG1A, which gives construction specifications. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

LINE MATERIAL

A McGRAW ELECTRIC COMPANY DIVISION

Permaline Fibre Conduit

BPI BITUMINOUS PIPE INSTITUTE

This seal is your guarantee of recognized quality in Bituminous Fibre Conduit.

265

350-Mw Wind Tunnel (*Continued from page* 18)

315 Mw at 3:00 am. Yet the total CEI system load at 3:00 am was the same as at 11:30 pm and much less than the load at 9:30 pm.

NACA's load increase approximately equalled the CEI decrease, and the total system load was held at almost the same level from 11:00 pm until 4:30 am. At 5:00 am the laboratory's load dropped rapidly, and the CEI system minimum for the day appeared shortly thereafter—instead of the normal 3:00 am minimum. During this particular day the NACA on-peak load stayed between 30 and 60 Mw.

The laboratory load can be curtailed in the event of system trouble. The CEI dispatcher evaluates the trouble and then discusses with the NACA dispatcher the maximum load the laboratory can be permitted until the system is back to normal.

The dispatchers also determine the rate of increasing and decreasing the load. The chart shows the load rising rapidly from 80 to 270 Mw and dropping even more rapidly from 300 to 100 Mw. The CEI dispatcher determines the maximum rate of change allowable at any specific time.

Smooth coordination of the laboratory load is achieved by a private telephone line between the NACA and CEI dispatchers and telemetering of lab's load to CEI dispatchers.

Stability Was Investigated

Mutual understanding and close coordination between the dispatchers has made the loading and unloading of the wind tunnel a smooth operation. The laboratory usually asks for power two or three hr before it is needed. Then, prior to granting the request, the NACA and CEI dispatchers discuss the requirements.

The new 10-by-10-ft wind tunnel has a rating of 250,000 hp continuously and 300,000 hp for 1 hr. When added to the 82,000-hp capacity of the existing 8-by-6-ft wind tunnel, the total induction motor load could reach 382,000 hp. Both transient and steady-state stability were investigated with the two tunnels at peak output.

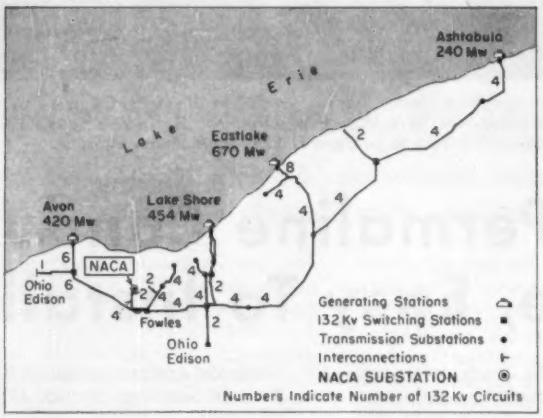
There are a number of ways of providing necessary stability:

1. High-speed generator regulators on those generators near the load improve stability. For this reason new high-speed regulators are being added to the newest generators at Avon, the station nearest NACA.

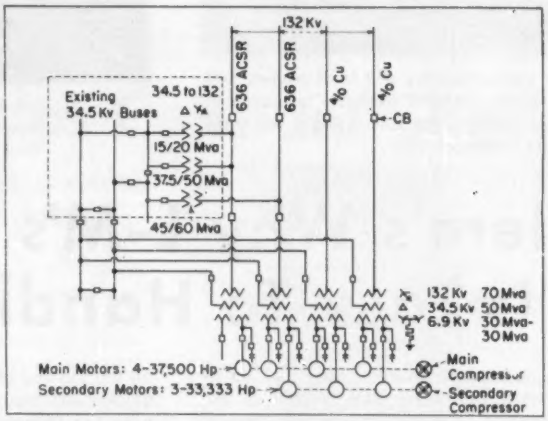
2. Fast clearing of the faulted circuit improves stability. For this reason the NACA lines have high-speed relaying.

3. Some means of maintaining voltage at the load during fault conditions improves stability. Sufficient synchronous condenser capacity near the load goes a long way toward providing necessary stability.

A considerable amount of ac network analyzer time has been used in analyzing this problem and determining the modifications needed.



CEI's 132-kv metropolitan system is tightly knit and can readily handle future load growth of the NACA facilities



FOUR 132/34/6.9-kv transformers, added to meet the wind tunnel's needs, tie into NACA's existing 34.5-kv supply

How NACA's Wind Tunnel Operates

Tunnel generates winds up to 3½ times the speed of sound; high-speed computers process the 40,000 data points daily

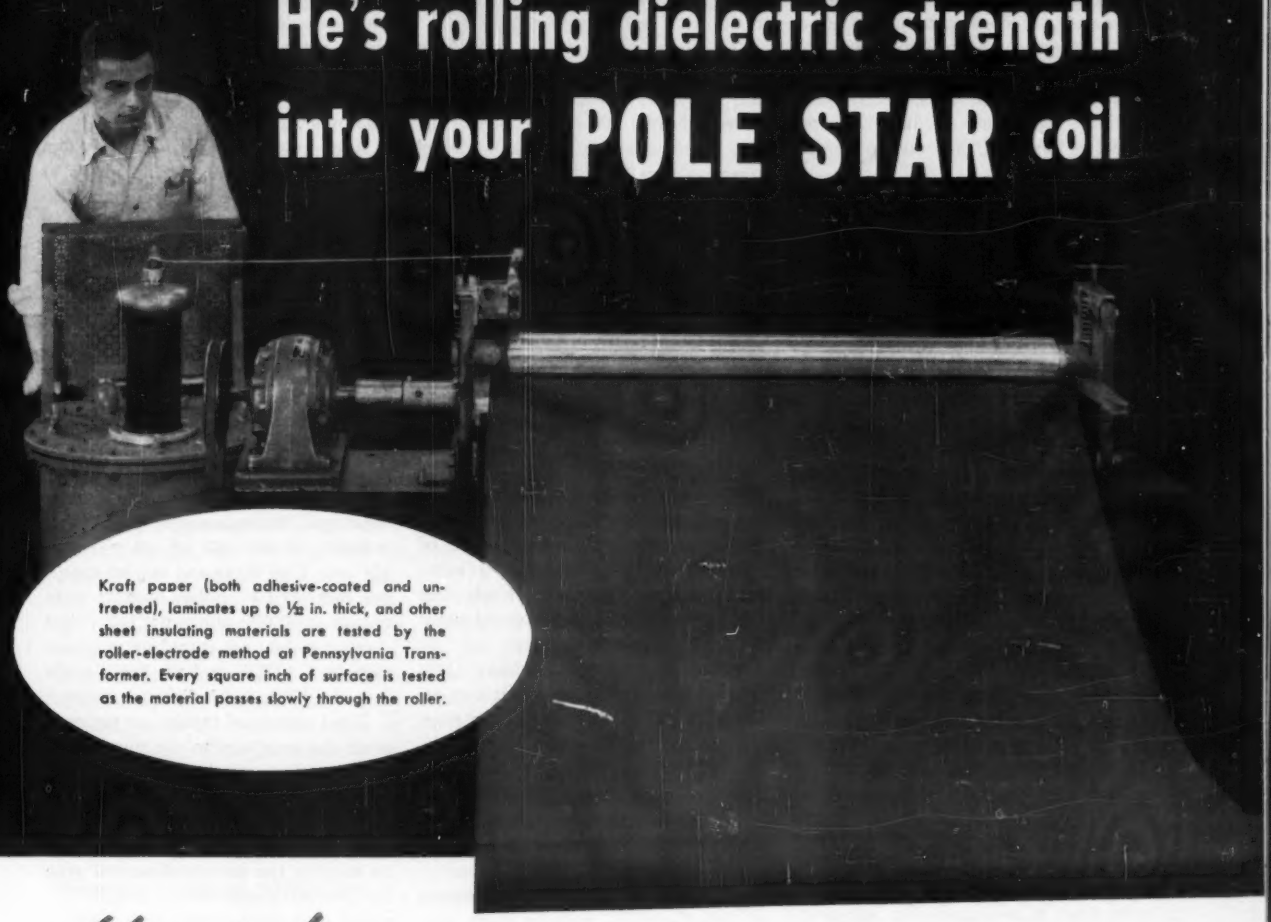
C. F. SCHUELLER, Chief, Supersonic Tunnel Branch, Lewis Flight Propulsion Laboratory, National Advisory Committee for Aeronautics, Cleveland, Ohio

The world's largest supersonic wind tunnel was placed in operation this year by the National Advisory Committee for Aeronautics at its Lewis Flight Propulsion Laboratory. The new test facility provides a 10-by-10-ft test section for investigating full-scale aircraft engines at conditions corresponding to those encountered in supersonic flight.

The tunnel fulfills a very definite need. The development of power plants for supersonic airplanes is highly dependent on the facilities for testing them at full scale. However, rapid increases in airplane speed have been accompanied by a corresponding increase in engine size to the point

(*Continued on page* 24)

He's rolling dielectric strength into your POLE STAR coil



Kraft paper (both adhesive-coated and untreated), laminates up to ½ in. thick, and other sheet insulating materials are tested by the roller-electrode method at Pennsylvania Transformer. Every square inch of surface is tested as the material passes slowly through the roller.

Here's how:

Unlike other insulation testing methods in wide use today, the roller-electrode test introduced by Pennsylvania assures accurate testing of every square inch of material. Voltage applied through the upper roll (the lower roll is grounded) converts the harmless-looking device pictured into a torture rack that is *certain* to reveal any existing weak spots — whether blisters, pin holes, inclusions of foreign matter, or some other defect in the material.

The roller-electrode test measures dielectric strength of insulation in the industry-approved units of volts-per-mil — that is, the amount of voltage that a particular thickness of a given insulating material is capable of taking without a breakdown. Rigid volts-per-mil minimum standards have been set up for insulating materials that go into Pole Star distribution transformers, and thorough testing by the roller electrode method is your guarantee that these standards are being met.

Each insulation manufacturer's material must pass acceptance tests before being approved for Pole Star insulation; after which batch checks keep the quality of the material under constant surveillance.

3 through 500 kva, through 67,000 volts

167 Production Controls make Pole Star Best!

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division **CANONSBURG, PA.** Greater Pittsburgh District

350-Mw Wind Tunnel (*Continued from page 22*)

where existing facilities have become inadequate for full-scale tests.

In the new test facility, fundamental research will be conducted on turbojet, ramjet, and rocket propulsion systems. NACA personnel will use the tunnel to determine the safe operating limits and methods of controlling these 100,000-plus-hp aircraft power plants.

To conduct these tests successfully, more than a ton of air per sec must be sped past models in the test section at velocities up to 3½ times the speed of sound. This feat requires two separate sets of induction motors that provide 250,000 hp for driving two axial-flow compressors.

The main compressor consists of eight stages of 20-ft-dia fans. It is designed for operating speed of 865 rpm and is powered by a 150,000-hp drive motor system. The secondary compressor is 12 ft in dia and has ten stages. It is designed for 855 rpm and requires a 100,000-hp drive at peak load. Both can operate at 50% rated speed.

Because air velocities ranging from 1,300 to 2,400 mph and altitudes varying from 50,000 to 150,000 ft are required in the test section, a wide range of operating conditions is demanded of the drive motors.

For example, with an air speed of 1,200 mph and an altitude of 50,000 ft, the main drive must produce 150,000 hp. Increasing the altitude to 100,000 ft requires only 15,000 hp of the main drive system. This relatively low power is obtained by eliminating electrically three of the four main drive motors.

The main drive is used throughout the speed range of the tunnel while the secondary drive is used only for speeds above 1,700 mph. Each of the two systems has a separate control room to accelerate the motors up to base operating speed within the power system limitations. Control is then transferred to the main control room, and adjustments are made to set the desired operating condition.

The over-all wind tunnel is about 450-ft long and 330-ft wide. But, only the test section—10-ft high, 10-ft wide, and 40-ft long—is used in research and development investigations.

Tunnel Has Unique Design

The tunnel embodies several unique design features. Three of them are:

- A flexible wall nozzle made of two 75-ft-long, 10-ft-high, 1⅜-in.-thick stainless steel plates. Each plate can be bent inward and outward about 22 in. to vary the airspeed.
- An air dryer that contains 1,900 tons of activated alumina. It can remove 15,000 gal of water per hr from the air drawn into the tunnel.
- A 24-ft-dia, 38-ton, two-position valve. In one position it directs the tunnel air into the atmosphere; in the other it seals the tunnel and makes it a re-circulating unit.

High-speed electronic computing machines process as many as 40,000 individual data points that are collected daily in the test section. NACA engineers developed a system of automatic recording instruments to collect experimental data in a form suitable for input to an ERA 1103 UNIVAC computer.

The automatic recording system converts within 10 sec as many as 300 unknown test pressures into electrical pulse signals. It operates by means of pressure switches and a pressure-scanning system called the Digital Automatic Multiple Pressure Recorder (DAMPR). Electrical signals from the DAMPR at this and other facilities within the laboratory are transmitted over telephone cables to the Central Automatic Digital Data Encoder (CADDE) to be digitized and recorded on magnetic tape.

An automatic digital potentiometer measures thermocouple and other voltages at the rate of six channels per sec. Fuel flows and engine speeds are measured by pulse-counting techniques at 40,000 pulses per sec. Then these raw data are stored on magnetic tape by CADDE and are fed directly into the ERA 1103 digital computer.

Final computed results are returned from the computer to the tunnel control room where they are automatically tabulated and plotted while the test is in progress. The project engineer can make use of this information to monitor the investigation and plan the next test condition.

How the Wind Tunnel Is Driven

Induction motor drive has adjustable speed and delivers 250,000 hp continuously and also 300,000 hp for one hour

M. D. HORTON, Systems Application Engineer, General Electric Co, Schenectady, N. Y.

National Advisory Committee for Aeronautics' new supersonic wind tunnel requires an electric motor drive system having adjustable speed and capable of delivering 250,000 hp continuously and 300,000 hp for 1 hr.

NACA's laboratory is now connected to four 132-kv lines which form the backbone of Cleveland Electric Illuminating Co's transmission system. These four lines operate in parallel at the 132-kv level only at the bus in CEI's Eastlake Plant. They are paralleled many places at lower voltage levels on transformer secondaries. In this manner the breaker interrupting ratings of the 132-kv system are reduced under those required with the 132-kv lines solidly paralleled.

Therefore the laboratory expansion required that the four 132-kv lines be paralleled at some lower voltage level for two reasons. They are: (1) to prevent loss of NACA load in the event one CEI line fails, and (2) to prevent excessive increase in short-circuit currents on the 132-kv system.

A 34.5-kv interior distribution system has served the laboratory since it was built in 1942. But growth of other NACA loads had rendered this system inadequate, and immediate expansion was necessary.

To accomplish these objectives at minimum cost, the transformers for the wind tunnel were designed with four windings. Each of the four new transformers is rated 70,000 kva with a 132-kv wye-connected primary operating with solidly grounded neutral.

Each transformer has a 34.5-kv delta-connected tertiary winding rated 50,000 kva maximum. It is brought out of the transformer for intercon-

nection to the 34.5-kv system. Each transformer has also two 6,900-v, 30,000-kva, wye-connected secondaries operating with neutral grounded through a 2-ohm grounding resistor.

Each of the four transformer primaries is connected to one of the four incoming 132-kv lines. The four 34.5-kv tertiaries furnish the necessary delta-connected windings and allow paralleling the four incoming circuits at the 34.5-kv level. They add an extra 200,000 kva of transformer capacity to the lab's 34.5-kv system.

The eight 6,900-v secondaries serve the main motor loads and the tunnel auxiliary loads at an economical voltage level. By breaking the transformer secondaries into two per transformer, the available short-circuit current capacity on the 6,900-v windings was reduced to the point where metal-clad switchgear was applicable.

The main drive system for the wind tunnel consists of four 37,500-hp wound rotor induction motors in tandem on one shaft to provide 150,000-hp for the primary compressor. A similar arrangement, consisting of three 33,334-hp motors, furnishes 100,000 hp for the secondary compressor. These seven motors are rated 6,600 v with 900-rpm synchronous speed. They operate from the eight 6,900-v transformer windings, leaving one spare winding for auxiliary and future loads.

Rheostats Dissipate 60,000 Kw

The main drive motors must deliver constant torque between 80 and 100% rated speed, and secondary drive motors between 70 and 100%. This speed adjustment was accomplished by installing liquid rheostat systems in the motor secondaries. They are capable of dissipating approximately 30,000 kw per drive, or a total of 60,000 kw peak.

All seven motors are totally enclosed, forced-ventilated, Class-B-insulated machines with surface air coolers and motor-driven ventilating fans installed in the foundation. Each motor has an axial-flow ventilating fan which delivers 110,000 cfm of cooling air and requires a 250-hp blower motor. The motors are designed for stator shift to facilitate maintenance of rotors and stators without disturbing shaft alignment.

Motors are connected to the compressor by a pneumatically operated disconnect coupling combined with a turning gear. The operator can engage and disengage the couplings by push-button when the machines are at rest. This provision will allow the motors to drive a future wind tunnel compressor from the other end of the motor shafts.

NACA SUBSTATION contains the main power transformers, also 132-kv disconnect switches, lightning arresters, cable potheads, and 83 Mvar of capacitors

An automatic speed-regulating system, using rotating amplifiers and electronic pre-amplifiers, drives pilot motors which position the liquid rheostat electrodes for the induction motors. This regulating system closely controls any desired compressor speed in the rated operating range. The regulator also causes all motors to share load and automatically controls constant rate of change of power during acceleration or deceleration.

The automatic control system accelerates the drive to minimum rated operating speed without the operator's attention. After reaching this base speed, the operator may adjust speed manually to any value, or instruct the drive to seek automatically any desired speed.

Maintaining constant speed during tests is important because it affects the aerodynamic conditions at the model. Under certain conditions even a slight unplanned reduction in speed can cause serious damage to the model undergoing test and to the wind tunnel compressor itself.

Protective relays monitor all vital temperatures and electrical machines. They initiate audible and visual alarms or automatic stopping of the system, depending on the seriousness of the trouble. Loss of one 132-kv line during operation at full load can be tolerated without load reduction because of the 34.5-kv system ties.

In event of serious troubles the operator can dump all load except auxiliary components and apply electrical dynamic braking to the motors. The protective relay type of stop, however, will clear automatically only the defective machine and will initiate an orderly controlled stop at an increased rate of power fall.

During a drive stop and after the motors are de-energized, dynamic braking is applied to reduce coasting time. This is accomplished by applying dc excitation to two phases of the induction motor stators.

To avoid trouble, a 175-kw diesel generating system drives the normal lubricating oil pumps for all machines. This diesel is the first machine started before the tunnel can be used. If the diesel or any pump fails, a separate full capacity emergency pump is started by a dual power source.

Capacitors Provide 83 Mvar

Power factor correction capacitors provide 83,000 kvar to correct the full load power factor of the system to 97% lag when measured on the transformer primary. The capacitors, installed outdoors in protective steel housings, are connected to the 6,900-v system through breakers.

Capacitor blocks as large as 13,800 kvar are switched in one step by separate breakers whenever a motor is energized. As there are separate motor and capacitor breakers, overvoltage caused by self-excitation of the motors can be avoided because capacitors can be disconnected.

CEI's incoming lines terminate in NACA's Substation A at the edge of the laboratory. In this substation are the 132-kv breakers, lightning arresters, disconnecting switches, metering, and the original installation of transformers stepping down to 34.5 kv.

High towers could not be used for the 132-kv lines within NACA because Cleveland Airport adjoins the laboratory. Therefore the 132-kv circuits were brought from Substation A to the wind tunnel by underground cable.

The 60-ft-deep, 2,000-ft-long cable tunnel has four aluminum cable racks,

(*Continued on page 51*)

Eddystone Unit Criteria Explained to ASME

Selection of size, steam conditions and heat cycle and meeting of exigencies imposed by selections are topics at New York meeting

Maximum advantage of new technology as far as it was economically feasible prompted the engineering of Eddystone No. 1 unit, the American Society of Mechanical Engineers heard at its annual meeting, Nov. 25-30, at New York.

This was the criterion in selecting the unit's size, steam conditions, and heat cycle, said J. J. Harlow, Philadelphia Electric Co. Only large-capacity turbines, he said, take full advantage of very advanced steam conditions. Thus 250 to 300 Mw was indicated. Maximum generator size had to fit into the plan for a tandem-compound, 3,600-rpm set, Harlow pointed out. With a supercharged rotor and stator, a 275-Mw generator was felt to be feasible.

Set Was Cross-Compounded

Analysis showed that improved efficiency obtained by increasing steam pressure, even at 1,200F, was not enough to warrant exceeding 5,000 psi. Although materials in normal use in power-plant service were limited to 1,150F, available materials would permit a 1,200F design in the critical highly stressed zones of the superheater and turbine rotor, and a code material was usable for piping.

Cross-compounding the set and using an 1,800-rpm, low-pressure turbine with long blades and enlarged exhaust promised performance improvement of about 150 Btu per kwhr, Harlow said. A study of Philadelphia Electric's system and interconnections showed about 325-Mw would be the appropriate size, and that the 50-Mw capacity increment was obtainable at substantially less than average cost. All factors together, he said, led to the choice of a 325-Mw cross-compound turbogenerator and a steam generator with a design output of 2,000,000 lb of steam per hr.

The steam-generating unit for Eddystone No. 1 is designed to deliver steam to the turbine at 5,000 psig at 1,200F and at a rate of 2,000,000 lb per hr, E. M. Powell, Combustion Engineering Inc., told the ASME. He pointed out that there are two stages of reheat, both at 1,050F.

A forced-circulation design of the once-through type was selected because no design was applicable which depended on separation of water from steam in a drum for recirculation through the evaporative circuits. Nor could impurities entering with the feedwater be concentrated in the boiler drum and removed through a blowdown system. These factors necessitated a revised approach to feedwater purification and changes in operating procedures and the control system design.

Radiant Superheaters Installed

A new arrangement of heating surfaces was required by the nature of the heat cycle and the amount of superheating and reheating, said Powell. In the superheaters and reheaters, 65% of the heat absorption occurs. Thus more use is made of radiant superheating surface than in conventional design. Radiant superheaters are installed on the upper furnace walls and many widely spaced platens are suspended in the upper portion of the furnace. For such an advanced steam cycle, a control system's most important function is regulation of steam temperature.

The small volumetric steam flow at the turbine inlet stage and the very large one at the exhaust blade were problems at Eddystone, according to C. B. Campbell, C. C. Franck Sr, and J. C. Spahr, Westinghouse Electric Corp. By splitting steam expansion between elements, they said, the smallest practicable element was obtained that could be subjected to pressure and temperature beyond present operating experience. This decision aggravated the problem of shaft seals, for which a solution appeared available. Advantages include:

1. Greater latitude in selection of high-temperature alloys, some of which are not available in large sizes.
2. Permits use of conventional casing design principles.
3. The rotor is relatively short and of small diameter, and individually located, which makes it particularly favorable for the sustained control of leakage losses.

Light-Water Reactor Gives 134 Mw

The Yankee Atomic Electric plant will be a pressurized light-water reactor for producing 134 Mw net electrical power, said Robert J. Creagan. He co-authored a paper with Glenn A. Reed, Yankee Atomic Electric Co, and W. C. Woodman, Stone & Webster Eng. Corp. Major purpose of the plant, said Creagan, is to put the pressurized water reactor on a nearly commercially competitive footing with convention steam plants, without sacrifice of inherent safety.

The reactor will produce 480 Mw of heat power, and the fuel cladding and structural material of the core will be stainless steel, he said. Calculated fuel costs per net kwhr will be 3 to 5 mills. The thermal and hydraulic design is based on full-load steam conditions of 520 psia, 471F at the steam generator outlet.

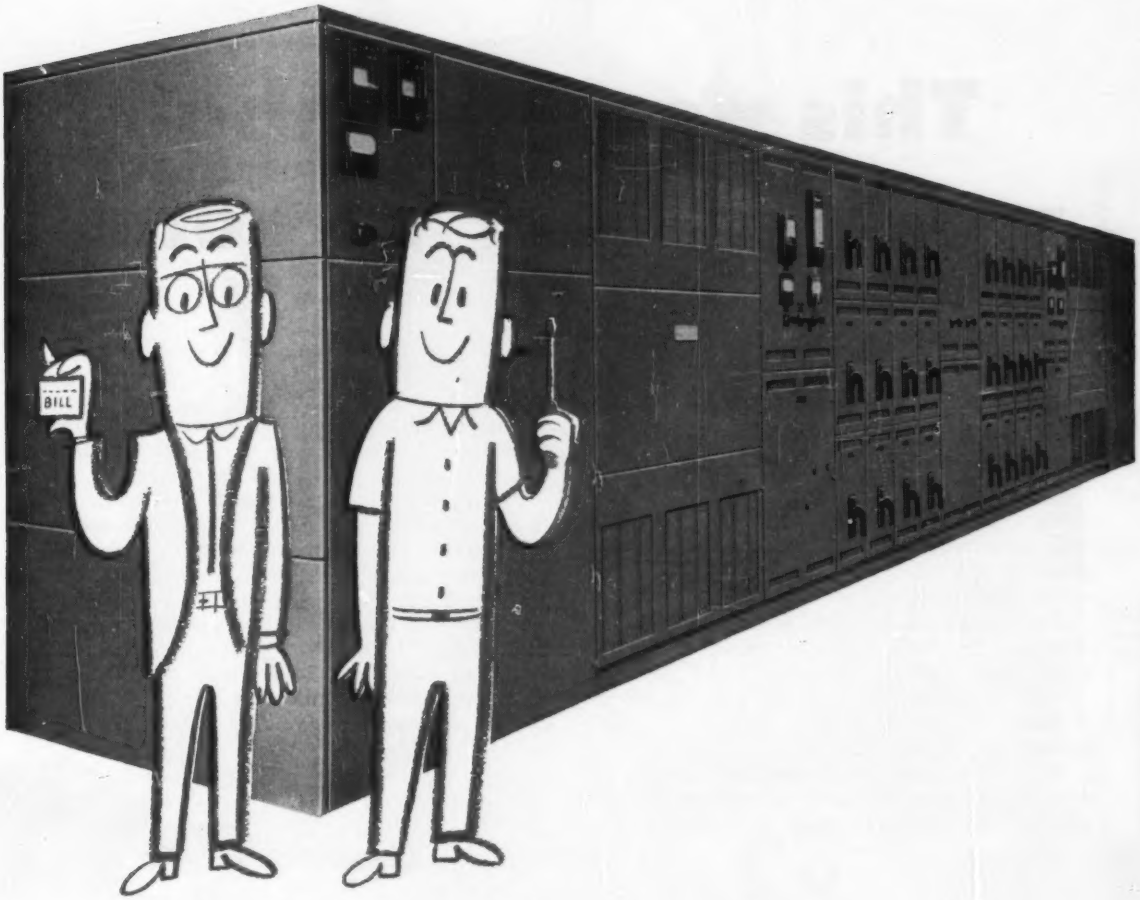
The Pennsylvania Advanced Reactor Project, according to its manager, W. E. Johnson, is carrying out studies for the design of an aqueous homogeneous reactor plant of 150-Mw output. The plant, planned for 1962 operation, will be on the Pennsylvania Power & Light Co system. Johnson was co-author with D. J. Fax, Westinghouse Electric Corp, and S. C. Townsend, PP&L.

Fixed Charges Considerable

Once in operation, the homogeneous reactor plant's most formidable problems concern maintenance of plant components, Johnson said. The project has pumped thorium oxide slurries in concentrations and at temperatures appropriate to the single-region homogeneous reactor for more than 3,000 hr. Although a breeder plant's bare fuel cost is essentially nil, fixed charges are considerable. Cost of the project's first reference design,

(*Continued on page* 30)

I-T-E Secondary Unit Substations



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I-T-E Secondary Unit Substations bring electric power nearer to where you use it—make it more dependable—save you time and money.
They do it in several ways:

- By bringing higher voltages nearer the load and reducing power losses
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I-T-E Secondary Unit Substations can be supplied for any application indoor or outdoor, and in any standard rating. For complete information, contact your nearest I-T-E sales office. Or write I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Phila. 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

An example of Allis-Chalmers leadership

This new neighbor won't bother anyone

New low-sound-level 125,000-kva transformer built by Allis-Chalmers for Wisconsin Electric Power Company bulk station in residential area.

Even residents of homes only 300 feet away will have no reason to complain about this good neighbor. It was specially designed to create good will.

Because of the location, Wisconsin Electric Power Company required a transformer with a low noise level.

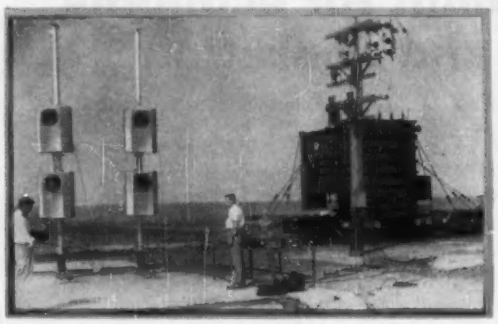
After careful study of the area, Allis-Chalmers designed and built a unit with frequencies melded to the ambient.

In addition, tests show that such factors as temperature rise, auxiliary losses and operating efficiency are extremely favorable.

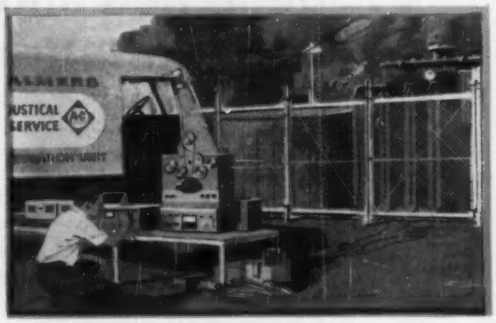
This installation is assurance that, where low noise level is important, you can look to Allis-Chalmers.

Transformers like this are an outgrowth of continued research by Allis-Chalmers into magnetostriction and resonance in the A-C Sound Laboratories, the Mobile Research Unit and the Acoustical Proving Ground.

For help in finding the best and most economical means for solving a sound problem, contact your nearby A-C office. Or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



Ten-acre acoustical proving ground provides first *practical* means for sound-level testing. Equipment on hand includes means for duplication of any area acoustically.



Mobile sound research laboratory unit can bring laboratory equipment to where substations are planned . . . helps you decide sound level of transformer.

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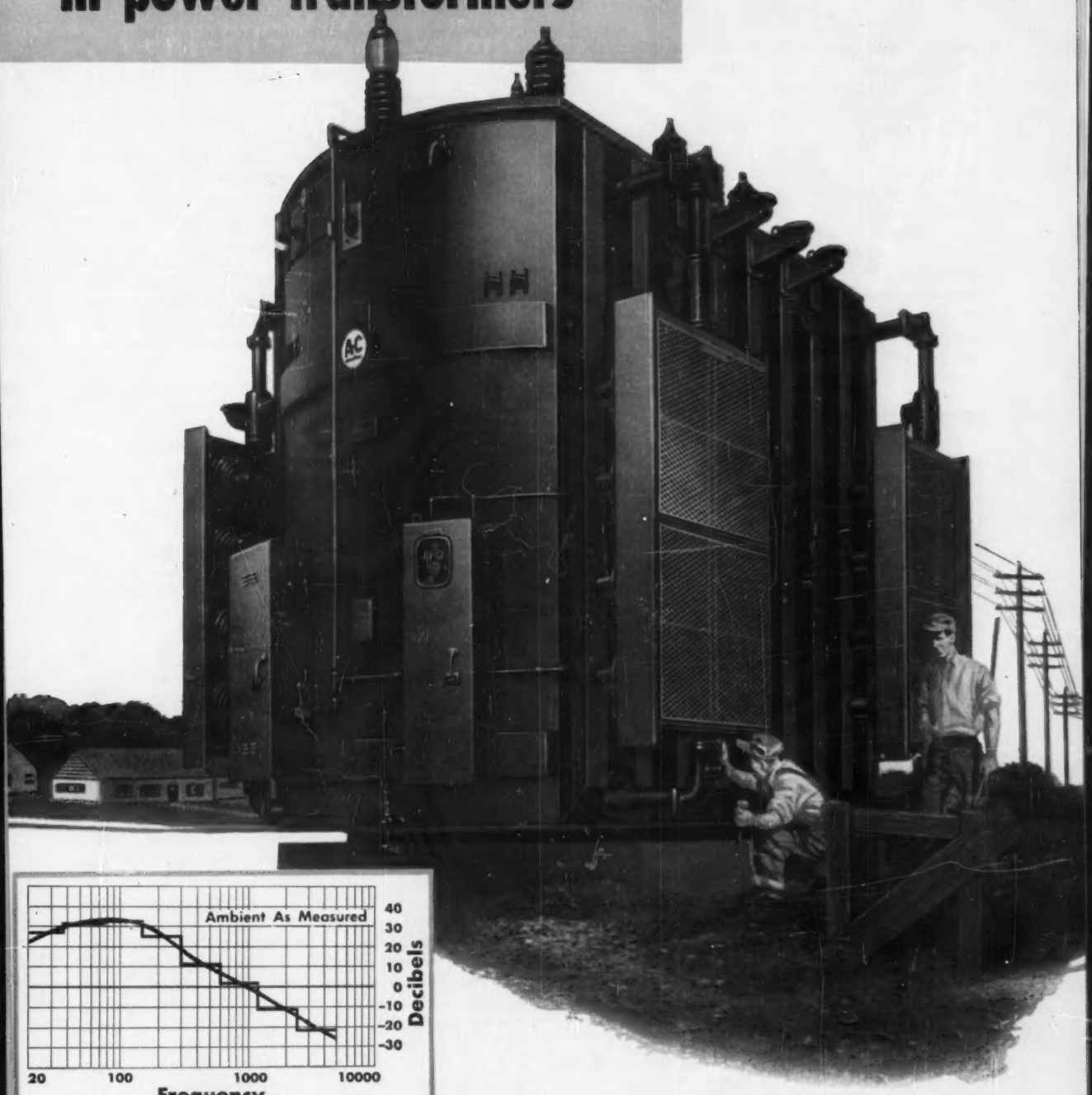
A-5225

in power transformers



Testing at 2:00 a.m. determined maximum masking noises . . . helped determine noise level which transformer could have without creating complaints from nearby residences.

Low sound level is feature of new 125,000-kva Allis-Chalmers transformer being installed in residential area.

CHALMERS

Atomic Plants Explained at ASME

(*Continued from page* 26)

only now being analyzed, is certain to be quite high.

Dresden Nuclear Power Station, an all-nuclear unit designed and built by General Electric Co for Commonwealth Edison Co, will be in service by 1960, said J. R. Wolcott. His paper was written in collaboration with V. A. Elliott, E. P. Peabody, G. M. Roy, J. L. Schanz, and G. Sege. All are of G.E. The station will have a 180-Mw net electrical output at 0.85 pf and 75F condenser cooling water. Its dual-cycle, boiling-water reactor was selected for good thermal efficiency for a given coolant temperature in the reactor; for simplicity making possible low capital cost per kw, and for use in large central stations, where it is desirable to modify the direct cycle to improve the power output per unit of core volume and the reactor response to load demand. Calculated net station heat rate is 11,893 Btu per kwhr, and the corresponding reactor heat output 627 Mw.

Fast-Breeder Type Chosen

The fast-breeder type reactor was chosen by the Detroit Edison group for its promise of abundant economical power, W. N. McDaniel, atomic Power Development Associates, Inc., told the ASME. J. F. Anderson and C. M. Heidel, Power Reactor Development Co and Detroit Edison Co, respectively, were his collaborators.

Cost of the Enrico Fermi Atomic Power Plant, said McDaniel, is estimated to be $54 million. Of this, $30 million will be spent on the reactor and auxiliaries, $14 million on steam electric generating facilities, $10 million on research, development, and business expenses during construction. The reactor is designed for an initial heat output of 300 Mw, 268 Mw being released in the core and 32 Mw in the blanket. It is expected that the ultimate total heat output will be 430 Mw.

The reactor for Consolidated Edison Co of New York's station 24 miles north of New York City will be a pressurized-water, converter type and the first commercial unit to use thorium as the fertile material supplementing the base fuel, uranium 235, according to G. R. Milne and F. R. Ward. They are associated with Con Edison and Babcock & Wilcox Co, respectively. Addition of superheat to the steam cycle, will increase capacity from 140 to 236 Mw and reduce cost from $322 to $233 per kw, they declared, pointing out that the cost figures are for a plant using only nuclear fuel as compared with one with a combination of nuclear boiler and separate oil-fired superheaters.

SGR to Have 75-Mw Output

The reactor, they said, is an internal thorium thermal converter, fueled initially with highly enriched U-235 and moderated and cooled with pressurized light water. In November most of the major equipment had been ordered. It is expected that the core will be installed in the reactor in the fall of 1959, and that initial critical operation will begin in December 1959. Full-power operation will be attained by May 1960.

The sodium graphite reactor (SGR), said F. C. Gronemeyer, is a low-pressure, high-temperature liquid-metal-cooled system using solid fuel and solid moderator. With R. C. Gerber, H. M. Hagaman, H. B. Holz, H. A. Ross-Clunis, and E. F. Weiser, all of North American Aviation, Inc., he reported on the proposed 75-Mw reactor for the Consumers Public Power District of Nebraska.

SGR's more important features, he said, are these:

1. A high coolant temperature (925F at present) is possible without requiring pressurization of the reactor heat extraction system.

2. The reactor can be adapted to a variety of fuel elements and operating conditions.

3. There are no chemical incompatibilities in the fuel element, coolant, structure combination.

4. Absence of releasable potential energy from pressurization or chemical reactions increases the inherent safety of the reactor system.

Coal Sales Assured

The ASME heard Perry D. Teitelbaum, National Planning Association Project on the Productive Uses of Nuclear Energy, declare that coal is subject to less competition than other fuels. The rapidly growing electric power industry, he said, has recently become the largest single coal customer, consuming approximately 140 million tons in 1955.

W. B. Gurney, Gulf States Utilities Co, described automatic logger and scanner systems at his company's Neches Power Station. J. A. Reich was his co-author.

He said the station's information center brings all important operating information to a central point for alarming, recording, or logging. Except those in the control room, log sheets and charts are eliminated. The center, he said, should improve individual unit and total plant efficiency and economy and relieve trained personnel for operation of new units.

The choice of feedwater preparation by evaporation and/or demineralization is proving to be dependent on individual installation conditions of labor, water quality, and economics, P. F. Baggish, Ebasco Service, Inc., declared. Either preparation, he said, appears to supply feedwater of comparable quality.

Steel Piping Described

Type 316 austenitic chromium-nickel-molybdenum steel will be used at Eddystone for design conditions of 1,200F, 5,600 psi because it gives a lighter wall thickness, said H. S. Blumberg, M. W. Kellogg Co. It is also easy to fabricate, particularly by welding, and has definite advantages in service operatioin.

A broad background of its metallurgy is available, he said, and the steel comes in seamless piping up to certain maximum dimensions. There are more than 20 years of experience in its heat treatment, and no problems in hot bending or in machining heavy-walled steel. It welds with less tendency to cracking.

Improved reliability of austenitic weldments is evident in service records based on the latest techniques, according to R. M. Curren and A. W. Rankin, General Electric Co. This improvement, they said, is due to developments in welding procedures, electrode compositions, and postweld treatments.

Difficulties with austenitic piping, they said, can be minimized by avoiding notches or sharp changes in section, especially near welded joints, insuring that piping systems move according to design to prevent excessively high bending stresses, and by a proper postweld heat treatment.

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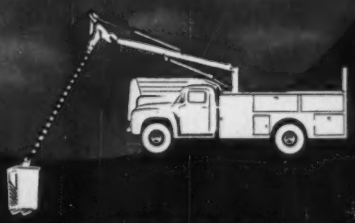
HYDRAULIC AERIAL BEAM

FOR WORKING IN HARD-TO-REACH PLACES WITH GROUND-LEVEL EASE



Over • under • around obstacles . . . Sky-Master quickly reaches out-of-the-way work — and provides on-the-ground safety and comfort for the workman.

Independently-operated steel beams are moved by double-acting hydraulic cylinders, through a unique system of linkage which greatly increases operating range. There are no chains, sprockets, or other secondary means of actuation. Supporting mast can be rotated *continuously* in either direction.

Work basket and insulated outer beam protects workman from 60,000 volts. Basket is automatically locked in position in event of damage to hydraulic lines.

The AB-1-41 . . . having ground-to-basket floor height of 41' . . . can be equipped for your particular job, and installed on a Powers-American Body that fits your needs.

The heavy-duty Series AB-37 and AB-43 Sky-Master carries two men up, out, over, or down. Available in 37' and 43' ground-to-basket heights.

Descriptive literature on Series AB-1 and Series AB Sky-Master — with price information — will be sent on request.

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Bullets and Insulators . . .

. . . How can they be kept apart? A Philadelphia "brainstorming" class attacks this $1-million problem

A class of business executives participating in a "brainstorming" class has suggested solutions to the problem of insulator damage during hunting seasons.

Dr B. B. Goldner, director of the School of Creative Thinking at La-Salle College, Philadelphia, mailed the following list to Philadelphia Electric Co. PE estimates conservatively that it spends $25,000 a year replacing insulators shot off poles. Nationally the damage is said to total $1 million a year.

Dr Goldner wrote that suggestions marked with dots may be worth some further thought, but pointed out that this is a "raw, unevaluated list." Here are suggestions that came from the free-thinking session:

Use unbreakable insulators.

Make insulators smaller.

• Design insulators to deflect bullets.

Put up decoys which explode with a bang, thus inviting target practice.

• Send a convincing letter to each hunter along with his license.

• Paint insulators baby-blue to blend with the sky.

• Mold insulators in the shape of a baby—who would shoot a baby?

Discard insulators. Insulate crossbars instead.

Indent insulators into crossbars.

Use bullet-proof covers.

• Write convincing articles for sports magazines.

Make insulators larger. Easy targets are no challenge.

• Use newspaper ads to educate hunters during the season.

Keep hunters away by law from sections having important power lines.

Raise license fees to cover possible damage.

• Raise electric bills of hunters only.

Put a hole in the middle of the insulator.

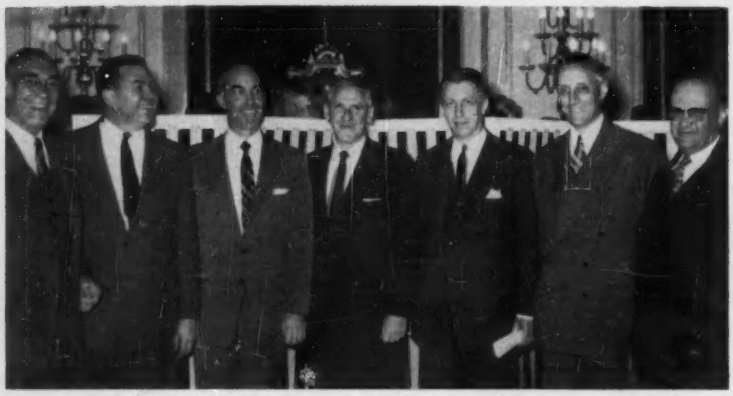
Have guards patrol important lines during the hunting season.

Set up targets on the ground, using fake insulators.

Pass laws with real "bite."

• Have insulators absorb bullets.

Set a legal limit on insulators.



U. S., Mexican Utility Men Confer

Closer cooperation and more exchange of technical information were top subjects for discussion when three United States utility executives conferred with top Mexican utility officials in Mexico City in early December. Pictured left to right are General William H. Draper, Jr, chairman of the board of Mexican Light & Power Co; Enrique M. Gonzalez, president, Mexican National Chamber of Electricity; B. L. England, president, Atlantic City Electric Co; Donald S. Kennedy, president Edison Electric Institute and Oklahoma Gas & Electric Co; Harllee Branch, Jr, president, Southern Co; Gustave Maryssael, president and general manager, Mexican L&P; and Ubrich T. Richter, manager, Amacuzac Electric Co. (McGraw-Hill World News.)

Hunter Kills Three Men With Co-op's Hot Wire

The Cass County (N. D.) Electric Cooperative Inc., noting the hunting season, reminded its members recently of a tragedy which happened "a few years ago:"

A hunter shot all 18 insulators on a double crossarm, destroying several completely. A high-voltage line looped over a little-traveled road, clearing the ground at about 2 to 3 feet. The hunter did not notify the Co-op.

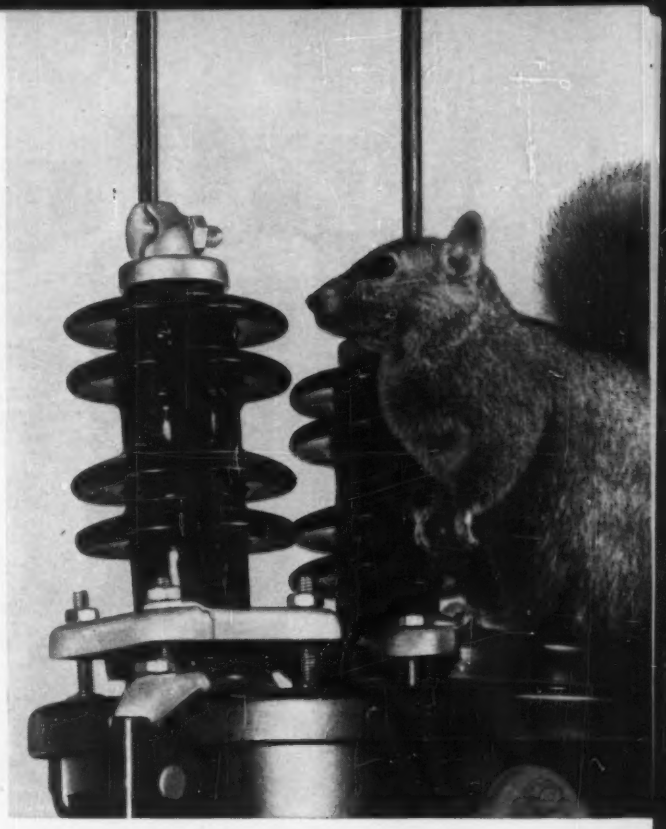
Early that evening, another hunter drove into the wire. He was killed in an electric flash as he stepped from his car.

The next day a neighbor, who volunteered to help look for the missing hunter, saw the parked car. Before realizing what had happened, he touched the hot wire. He was killed.

That night, two more men in the search party drove down the road but from the opposite direction. As they investigated by the feeble beams of flashlights, one tripped over the wire. He was killed.

Cass County Co-op asked its members to notify authorities and the utility if they see hunters using its distribution system for target practice. It offers a reward for evidence leading to the arrest of such persons.

Nut Bites Squirrel... Costs Utility $3000



You'll never believe it—we didn't either, but it actually happened! A curious squirrel evidently took a bite of the nut on the connector on top of a 7620-volt transformer—with the inevitable result. The nut bit back!

The squirrel's flaming body dropped into the dry grass below, which caught fire and in turn set the pole ablaze. Eventually the pole burned through, dropping primary wires onto the secondaries below.

Result: the pole had to be replaced—and so did some 30 television picture tubes in customers' homes. The whole deal was embarrassing and costly to the utility company—and to the squirrel's family also, which probably still has never satisfactorily explained to the neighbors what happened to Pappy.

It Can't Happen Here... on L-M's New Bite-Proof Transformer Bushing

This new bushing is designed to take the tap vertically, conforming to EEI-NEMA standards. Not only does it have a hand-tightening knob (which can't be spun off—but can be intentionally removed) but also it has a phenolic cap which covers the terminals completely. No hot nuts or other live parts are accessible.

If you use bare wire jumpers, we suggest a neoprene sleeve, as shown. The phenolic cap is constructed so as to provide adequate drainage.

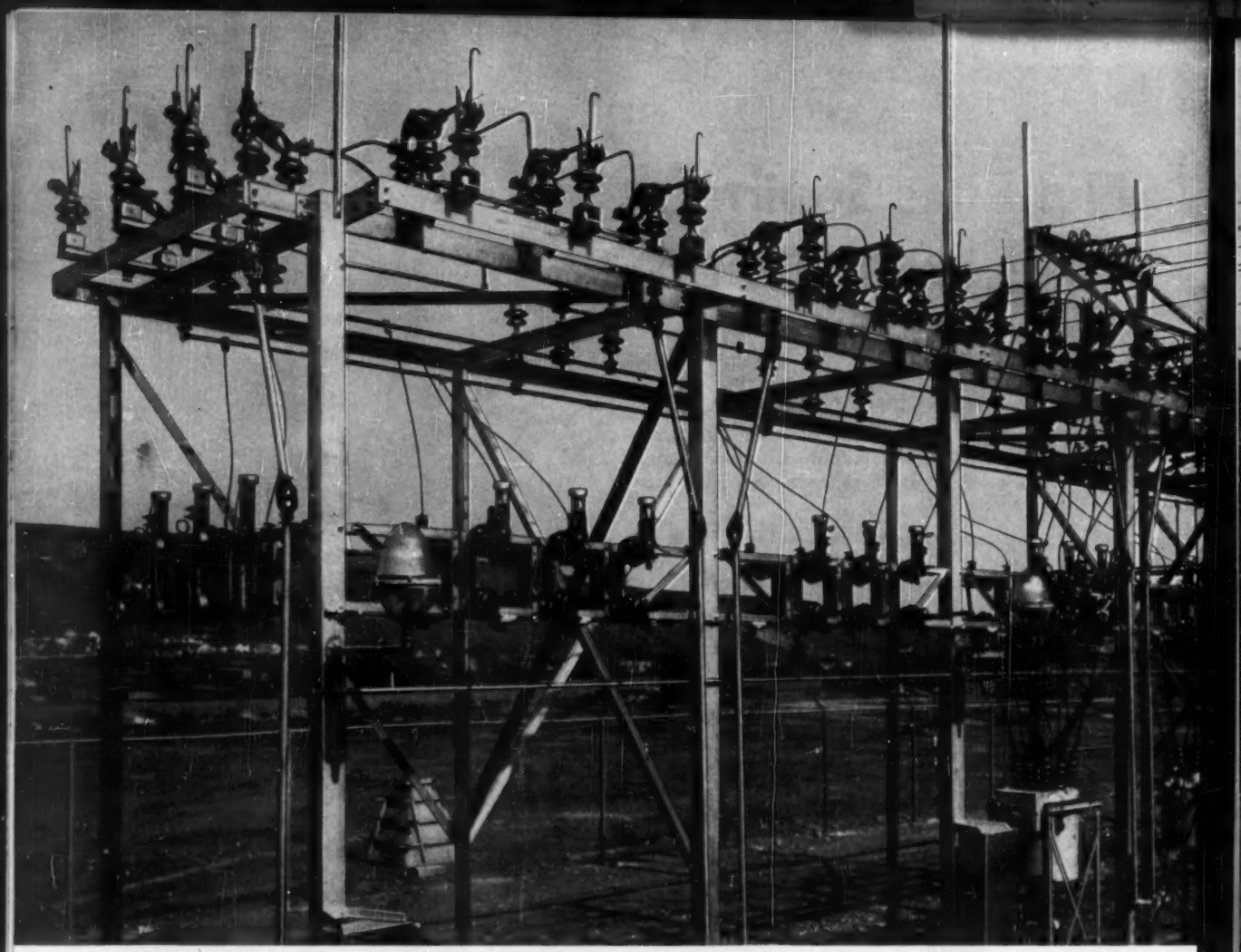
On protected transformers a 3/16-inch slot is provided for the lightning arrester terminal. Nothing except the most persistent hummingbird sitting on the arrester could reach the hot terminal—and that's pretty unlikely.

This new bushing is representative of the many plus features found only in L-M Round-Wound Transformers®—and another reason why you should order more L-M Round-Wounds. Ask the L-M Field Engineer to tell you other reasons for buying these outstanding and highly efficient transformers. Or write Line Material Co., Transformer Div., Zanesville, Ohio.

284

LM® LINE MATERIAL Transformers

A McGRAW ELECTRIC COMPANY DIVISION



Nine L-M power switches and 20 hook switches at the 13.8 kv 20,000 kva switching center of a Northwest utility. L-M also furnished other equipment and apparatus.

How L-M Switch Design Insures High Thermal Capacity, Positive Operation

High-pressure silver-to-silver contacts provide cool operation; powerful lever advantage to open and close switch insures easy operation at all times.

by **HARVEY BAERWALD**
Sales Application Engineer
Power Switching And
Substation Section
Line Material Company

Line Material has designed high thermal capacity and trouble-free operation into its line of power switches. Powerful lever advantage of the operating mechanism and silicone-grease-lubricated and sealed bearings at all moving joints insure positive operation to open or closed switch position regardless of ice, corrosion, or long periods of non-operation.

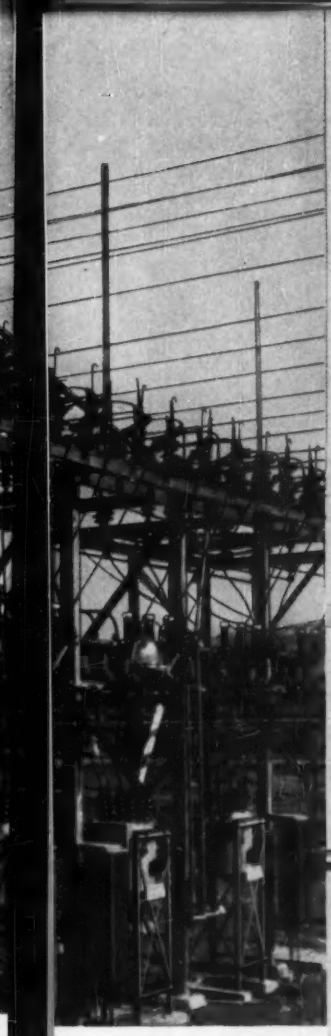
Tremendous Lever Advantage

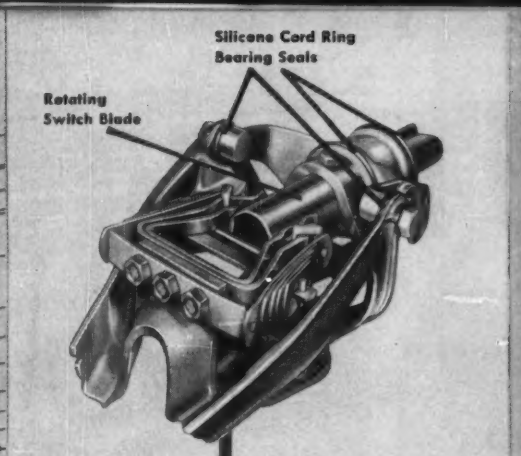
Operating mechanism provides a tremendous lever advantage by utilizing unique rotating switch blade design. Before the blade even begins to rise in the contacts, it is rotated 26 degrees—the full force is applied to blade rotation, breaking any possible condition of ice, corrosion, or contamination.

Smooth, Easy Operation

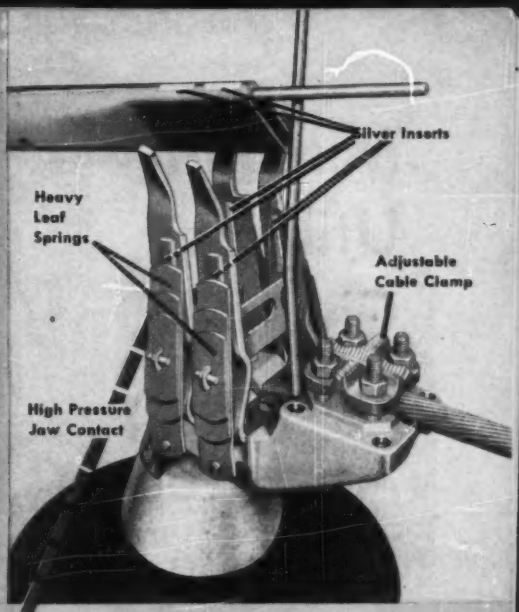
The hinge operating mechanism also provides smooth, positive blade rotation and blade rise. All bearings and all moving joints on the switch and on the interphase mechanism assembly are silicone-grease-lubricated for life and positively sealed with silicone cord rings.

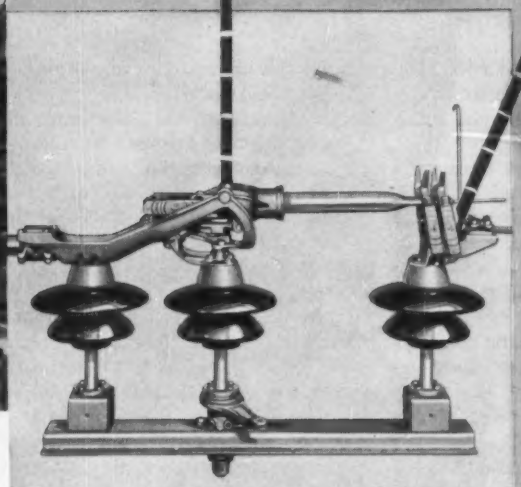
LM® LINE MATERIAL
A McGRAW ELECTRIC COMPANY DIVISION



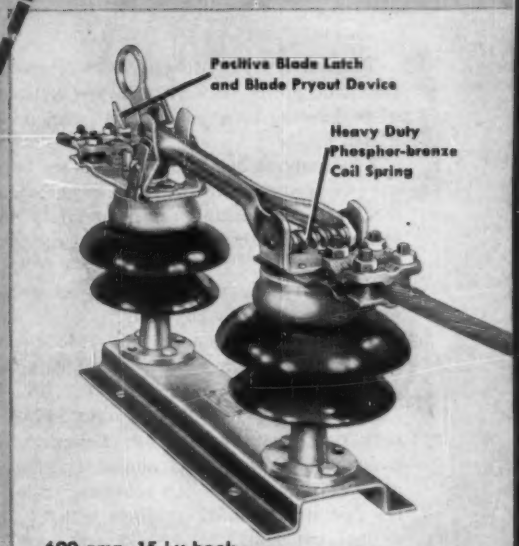


Hinge Mechanism showing
L-M outstanding features





1200 amp. 34.5 kv vertical break
type PV switch



600 amp. 15 kv hook
stick operated Disconnect Switch

Grease can't get out; water, dust, or dirt can't get in to freeze or start corrosion.

On 69 kv ratings and above, a counterbalance spring is provided to counteract blade weight. It is a self-centering, double coil, floating spring which is positive acting and trouble-free.

High Thermal Capacity

L-M's power switching equipment provides extremely high thermal capacity for both continuous current and short-time high current carrying applications.

Silver inlays in both blade and contact shoes insure high current-carrying capacity at both jaw and hinge contacts. During the closing operations, blade rotation provides a wiping action assuring clean silver-to-silver contact surfaces.

The jaw contact assembly has large copper shoes which exert 175 pounds pressure on the silver-to-silver contacts. This high pressure is maintained by heavy leaf springs to provide uniformly high thermal capacity.

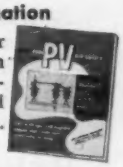
L-M's power switches also have fewer current interchange points because the terminal connectors are designed as an integral part of the contact adapter.

Simple Construction

Turnbuckle interphase adjustments make L-M group-operated switches easy to install. Flexible interphase mechanism assures positive operation without periodic maintenance, even after the structure has become severely distorted.

Get Complete Information

Ask your L-M Field Engineer for information and bulletins on L-M's Power Switching Equipment. Or write Line Material Company, Milwaukee 1, Wis.



Power Switching Equipment

Missouri Utilities Give University Analyzer

DEDICATORY INSPECTION PARTY consists of Dean Hiber O. Croft, left; Gen Leif J. Sverdrup, explaining control panel to University Pres Elmer Ellis; J. S. Palmer, Kansas City Power & Light Co; and W. R. Stephens, Sverdrup & Parcel, Inc

The University of Missouri recently accepted a $200,000 electronic power network analyzer donated to its college of engineering by a group of Missouri utilities and industrial firms.

The analyzer culminates a program begun three years ago when the university's electrical engineering department started soliciting aid from utility engineers in the state. The thinking behind the program was, and still is, two fold:

1. Helping the university to meet ever-increasing demands for electrical engineers.

2. Allowing operating utilities to evaluate contemplated expansions more economically and to study capacities of present facilities.

The 18-generator Westinghouse AC Network Calculator has recent technical developments: Six generators which keep the power output constant regardless of changes in the system. An automatic scale selector enables the operator to make readings without changing scales, a light indicating the scale to be read. Using built-in circuit-metering equipment, the operator may meter all parts of the analyzer from his desk.

The analyzer consists of these units:

18 generator units, six with automatic watt regulator control.

18 generator reactance units.

76 line impediance units to represent lines, transformers and reactors.

38 pi-line units to represent long transmission lines by equivalent pi-circuits.

39 load units, each with associated "Load Adjusting" autotransformers and voltmeters.

15 capacitor units to represent synchronous or static capacitors.

18 mutual transformer units to permit representation of mutual reactances.

18 autotransformers to represent variable ratio transformers and to change voltage levels.

MU spokesmen emphasize that the analyzer will be used primarily in teaching and research. The contract with the participating corporations specifies that the university will use it exclusively in teaching for a minimum of nine weeks a year and that it will be available to industrial companies on a schedule-in-advance basis.

According to Dr Joseph C. Hogan, associate professor of electrical engineering and analyzer supervisor, use of the analyzer will not be limited to the contributing companies and the university. When the schedule permits, it will be available to engineers of companies throughout the Midwest.

When the analyzer is used by a utility, its operation may be observed by students. It is felt that this arrangement will promote closer relationship among industry engineers, faculty members, and students.

The analyzer will operate, except for educational purposes, under regulations and policies formulated by an advisory committee of three university representatives and one representative from each contributing company.

The suite where it is housed includes the instrument and control room, a consultation and blueprint room, and an office for supervisors and personnel. Special lighting fixtures in the instrument room provide maximum, shadowless light.

Companies which contributed to the purchase of the University of Missouri's AC Power Network Analyzer include the following:

Arkansas-Missouri Power Co, Blythesville, Ark.
Central Electric Power Co-op, Jefferson City, Mo.
Empire District Electric Co, Joplin, Mo.
Kansas City Power & Light Co, Kansas City, Mo.
M & A Electric Power Co-op, Poplar Bluff, Mo.
Missouri Public Service Co, Warrensburg, Mo.
Missouri Utilities Co, Cape Girardeau, Mo.
St. Joseph Power & Light Co, St. Joseph, Mo.
Sverdrup & Parcel, Inc, St. Louis, Mo.
A. B. Chance Foundation, Centralia, Mo.
Union Electric Co, St. Louis, Mo.

Watch for the KUHLMAN

"Salesman of the Week"

Every week a new face to identify!

Every week a gift for some lucky reader!

Here are the details:

Sometime during 1957 the Kuhlman salesman who calls on you will deliver a personal message direct from these pages. His picture will appear in the ad without identification. When you recognize your man, contact Dept. SA-1, Kuhlman Electric Company, Bay City, Michigan immediately. The first reader* correctly identifying the Kuhlman "Salesman of the Week" will receive a valuable gift by return mail.

Remember: The ads begin January 1. A different salesman will appear each week throughout 1957. If you don't know your local representative by sight, call him today and get acquainted. You'll like his friendly service.

**Only entries from the general area served by the featured salesman will be honored*

571

KUHLMAN ELECTRIC COMPANY

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

New Allis-Chalmers

Ratings of FZO

14.4 kv, 500,000 kva to
69 kv, 3,500,000 kva

A-C ALLIS-CHALMERS

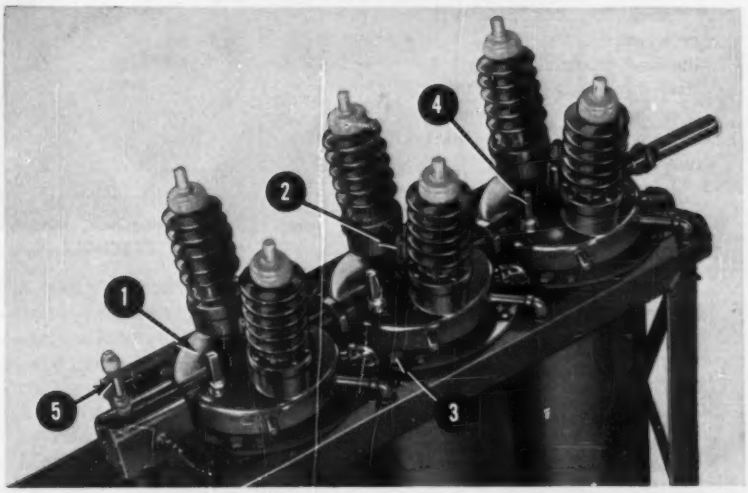
ALLIS-

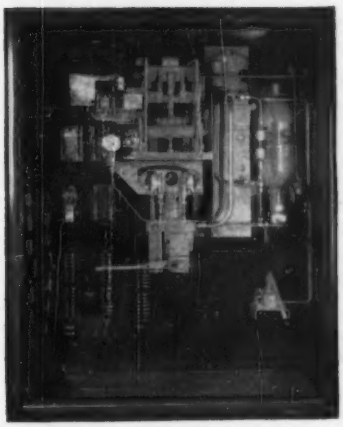
A-5256

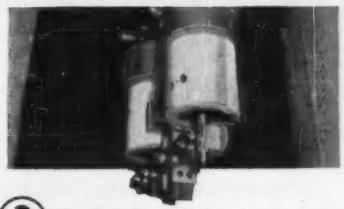
FZO frame-type breaker

brings you these (4) features:

(1) New Top . . . including (1) self-cleaning, smooth fabricated steel top for each tank; (2) external adjustment of overtravel stop (without using feeler gauges); (3) only four bolts per tank for easy lowering; (4) high visibility float-type oil gauge and (5) ball-type position indicator visible from 360 degrees.







(2) Pneu-Draulic operator has few moving parts . . . has proved itself reliable in dozens of utilities throughout the country . . . provides full-speed emergency closing (using hand pump) even without control power.

(3) Turbo Ruptor device features tulip and bayonet contacts. These lessen mechanical impact forces through tapered design of bayonet and provide wiping action for positive contact. Multiple tulip segments eliminate contact bounce.

(4) Full Access to tanks and contacts. Access is unobstructed by frame members. In addition, lowering of tanks is simple; only four bolts hold each tank to the frame. Full tank skirt is provided on each tank to add stability when tank is on the ground.

...plus power-operated Tank Lifter

Eliminate hand cranking! Let hydraulic cylinders raise and lower tanks safely — effortlessly. This unique A-C feature is a natural extension of the *Pneu-Draulic* operator. Easily installed . . . cylinder rods slip into tank bolt holes at top of tank.

Easy to operate . . . simply open one of two valves to lower tanks — the other to raise tanks.

Safe . . . tanks will lower at predetermined speed even if hose and fittings are accidentally removed.

Lifter consists of two hydraulic cylinders and flexible hose. Hydraulic pressure is from the accumulator or pumps of the *Pneu-Draulic* operator system. If breaker doesn't have a *Pneu-Draulic* operator, a battery operated unit is available.

This is only one of many features brought about by the redesign of Allis-Chalmers frame-type breakers.

For details see Bulletin 71B8475. Contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

CHALMERS

Pneu-Draulic and *Turbo Ruptor* are Allis-Chalmers trademarks.

Southern Services Ups Scholz and Gaston

Herbert J. Scholz, formerly president, has been elected chairman of the board of Southern Services, Inc, mutually owned service company of the Southern Co system. He is succeeded as president by Ernest C. Gaston, previously vice president and chief engineer.

Scholz has been associated with the companies in the system in engineering and construction work for more than 35 years. During that time he was largely responsible for the development of an integrated production and transmission system of the Southern Co.

The new board chairman has also been active in atomic energy development work and has represented the Southern Co in its participation in Power Reactor Development Co, of which he is now a vice president. A graduate of Stanford University, Scholz was associated with General Electric Co before joining a predecessor of the Southern Co. He has served as president of Southern Services since its formation in 1949.

HERBERT J. SCHOLZ

ERNEST C. GASTON

Gaston, who now assumes the presidency of Southern Services, joined the Southern Co group about 30 years ago following his graduation from the University of Alabama. His work with the organization has been concerned mainly with designing steam electric plants. During the past 16 years, the group he supervises has designed approximately 3-million kw of steam electric generating capacity in the four states in which the Southern Co operates.

In other major executive changes, R. H. Freese was elected a director, vice president, and comptroller to succeed H. M. Tickle, who is retiring at the end of this year. J. M. Reynolds will assume the post of treasurer, formerly held by Freese, and O. E. Charlton is newly appointed electrical engineer. In addition, J. J. McDonough, president-elect of Georgia Power Co, was elected a director.

GE Appoints Ginn and Parker Vice Presidents

General Electric Co has announced the election of two new vice presidents—William S. Ginn, general manager of GE's Transformer Division for the past two years; and Jack S. Parker, former general manager of the Aircraft Gas Turbine Division. Both are among the youngest ever elected to a GE vice presidency.

WILLIAM S. GINN

A graduate of Georgia Tech, Ginn has been with GE since 1936. After completing the company's engineering training program, he was assigned to the Power Transformer Engineering and Transformer Sales Divisions. In 1945, following four years of service in the Navy, Ginn returned to GE. He was named assistant manager of the Power Transformer Sales Division in 1947, and became division manager later that year. From that post he was promoted to assistant manager of sales for the Transformer and Allied Products Divisions in 1949. He rose to manager of sales the next year, and in 1952 was appointed general manager of the Transformer Division's power transformer department.

Parker has been with GE since 1950, when he was named manager of the Separations Division. He later was appointed assistant manager of design and construction for Hanford Atomic Works production facilities. In 1952 he became operation manager, aircraft nuclear propulsion project, then was general manager, small aircraft engine department. A Stanford graduate, he knew the shipbuilding and chemical fields.

JACK S. PARKER

Wagner TRANSFORMERS...THE CHOICE OF LEADERS IN INDUSTRY

Where uninterrupted power is a must...

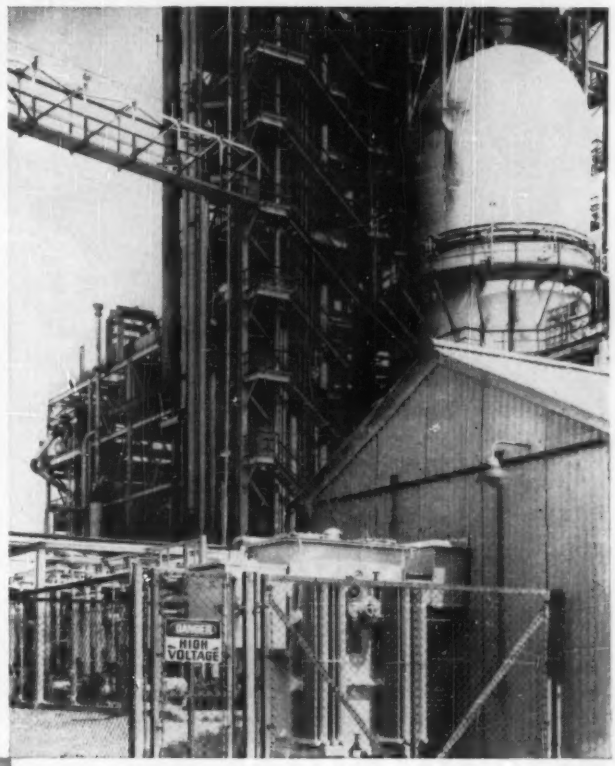
WAGNER UNIT SUBSTATION TRANSFORMERS

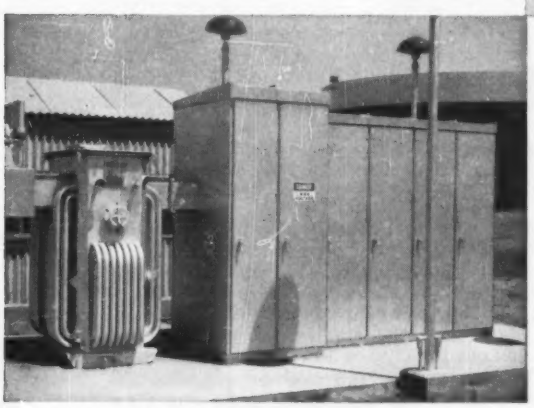
A completely dependable power supply is a vital necessity to an oil refinery. A power interruption of only a few minutes on a "cat cracker," like the one shown at the right, would completely disrupt this important processing operation and cause a shut-down of the entire refinery.

That's why you'll find Wagner Unit Substation Transformers at work at the Carter Oil Company refinery at Billings, Montana.

Wagner transformers are often found in installations where power supply failure would incur great loss because they have a reputation for complete dependability—backed by sixty-five years of transformer building experience.

Wagner Unit Substation Transformers, both liquid-filled and dry-type, are carefully designed to meet distribution requirements. Both liquid-filled and dry-type unit substation transformers are built in ratings through 2000 kva, 15 kv and below—you can choose the type and rating that exactly meets your load-center distribution requirements. Call the nearest of our 32 branch offices, or write us.





The 750 kva, 2400/4160Y to 480 volt, 60 cycle, three-phase, liquid-filled Wagner Unit Substation Transformer feeds the catalytic unit at The Carter Oil Company refinery. At left is shown a 225 kva Wagner substation transformer connected to an outdoor substation at the same refinery. Purchased and installed by The Fluor Corporation, Ltd., Engineers and Constructors for the Petroleum, Chemical and Power Industries, Los Angeles.

* * *

Write for Bulletins TU-205 and TU-214. They give full information on Wagner Unit Substation Transformers. Consult the nearest of our 32 branch offices about your next transformer installation.

Wagner Electric Corporation EST. WE 1891

WT 56-9

...to help America LIVE BETTER—*Electrically*

LIVE BETTER ELECTRICALLY

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

After clamp is dipped in oil carrying magnetic particles, it is magnetized in Magnaflux coil.

When inspected under "black light", any defects have plainly visible fluorescence.

TO SEE THE INVISIBLE

We Use "BLACK LIGHT" to Inspect Hi-Lite Strain Clamps

An important goal of Ó-B's inspection program is to make sure every Hi-Lite Strain Clamp which you receive will perform within rated strengths. To assure freedom from defects that might impair strength, we use a series of inspection safeguards.

Defects that can be seen are no problem. We catch them on visual inspection checks and by routine checking during manufacture. But what about defects that aren't visible?

To see the invisible, we examine Hi-Lite Clamps under the "black light" — the ultraviolet rays that are part of the Magnaflux-Magnaglo inspection method. Each clamp is dipped in an oil carrying magnetic particles, magnetized and then checked with the "black light." Under "black light", even the smallest defect glows and is plainly visible to the inspector.

But Magnaflux is more than an inspection tool. It's also a method of quality control. We're not content just to find defects. That's just the starting point. We then seek out the causes and eliminate them.

Actually, we find few defects. But according to our reasoning, even one flaw would be too many, if it weren't detected. Magnafluxing of every Hi-Lite Clamp is another good example of Technical Competence in action, working to deliver a completely reliable product.

OHIO BRASS COMPANY • MANSFIELD, OHIO

TECHNICAL COMPETENCE THE HEART OF ALL Ohio Brass HARDWARE

Alcoa Elects Haight to VP Post

James P. Haight has been elected vice president in charge of engineering and purchasing for Aluminum Co of America. He succeeds Thomas D. Jolly, who has retired after almost 42 years with the company.

Haight, a 36-year Alcoa veteran, has been a vice president since last April. A mechanical engineering graduate of Columbia University, he was first employed in various divisions of the firm's Edgewater, N. J., operations. In 1929 he transferred to the Central Engineering Division and two years later he became chief engineer of fabricating operations at Alcoa, Tenn. He was named chief works engineer at Edgewater in 1937. After World War II Haight was assigned to the Fabricating Division, first as works manager, later as assistant division manager, and in 1951 as manager. He was appointed chief engineer for Alcoa in 1954.

JAMES P. HAIGHT

PERSONAL BRIEFS

William L. Yoder will become secretary of Carolina Power & Light Co on Jan. 1 to replace **Capers J. Curry,** who is retiring . . . **James B. Woodyatt,** former vice president and general manager of Power Corp of Canada, Ltd, has been elected chairman. **A. Deane Nesbitt** is new president and **P. N. Thomson** becomes vice president-general manager.

Ralph E. Moody to Retire

Ralph E. Moody, chairman of the board of directors of Union Electric Co since 1954, has announced that he will retire at the end of the year.

Moody, who has served in an executive capacity since joining the utility in 1941 as vice president-operations, was elected executive vice president in 1947 and executive vice president-general manager in 1952.

Millard F. Clement has been named assistant vice president and **Ralph A. Smith** manager of power supply for Rockland Light & Power Co.

Duke Power Co has announced the promotions of **C. B. Miller, Jr,** to assistant to the vice president; **D. W. Jones,** to assistant supervisor of branches; and **Joseph C. Mason** to Winston-Salem district manager.

New assistant general manager of Kentucky Power Co is **Waldo S. La-Fon.** He is succeeded as manager of Appalachian Electric Power Co's Beckley district by **J. V. Mann. George E. Hervey** becomes Point Pleasant district manager.

W. P. Patten has been named manager of Arkansas Power & Light Co's Northeast Division to succeed **Ralph D. Caldwell** who retires. Rising to Patten's former post of Eastern Division superintendent is **George C. Davis,** while **Richard E. Stephens** becomes division engineer.

Newly named Fellows of American Institute of Electrical Engineers are **William K. Sonneman,** Westinghouse Electric Corp; **Sebastian L. Scheffer,** Burns & Roe, Inc; and **Theodore D. Reimers,** Consolidated Edison Co of New York, Inc.

J. R. Mills has been designated supervising engineer in charge of construction of Indiana & Michigan Electric Co's new 450,000-kw Breed plant which is now under construction near Terre Haute, Ind.

Niagara Mohawk Power Corp's new electric department system supervisor is **Frederick J. Raps.** Succeeding him as general superintendent of transmission and distribution for the Buffalo district is **Irvine H. Frey.** In another promotion, **Leo J. Melican** was named to replace retiring **Claude Gallagher** as superintendent of transmission and distribution for the company's Eastern Division.

OBITUARY

Herman J. Gallagher, 64, general farm service supervisor for Consumers Power Co, died in Detroit after a brief illness.

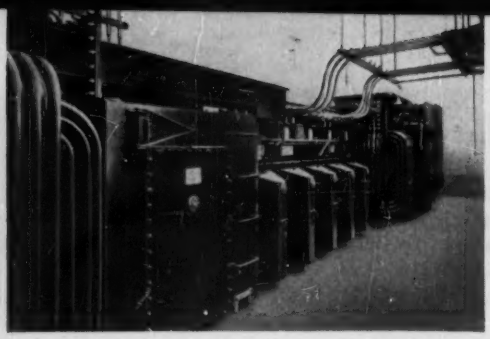
George Wellington Hamilton, 76, hydroelectric engineer and a Fellow and charter member of American Institute of Electrical Engineers, died in Washington, D. C., of a heart attack. Hamilton, who had 56 years continuous experience in the electric utility field, was a former vice president of Central Illinois Public Service Co and of Middle West Utilities. At one time he was chief engineer of Interior Department's Division of Power.

J. A. Harrell, South Carolina field representative of the Rural Electrification Administration, died suddenly at his home in Columbia.

Eugene North, 60, former superintendent of service and appliances for Puget Sound Power & Light Co, died in retirement following a short illness.

1931

FIRST UNIT

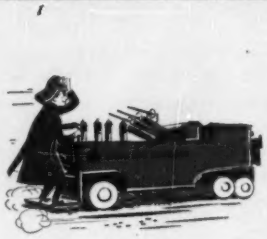


1 Sam's first Unit Substation was installed on an electric utility system in 1931. It is still in operation, still carrying load.

This is the story of "SUBSTATION SAM"
and a quarter century of great importance
to the electrical industry.
It's the story of 25 years of
Unit Substation progress.

25 Years of Helping Electrify America

2 The depression years momentarily diverted Substation Sam's sales attention...



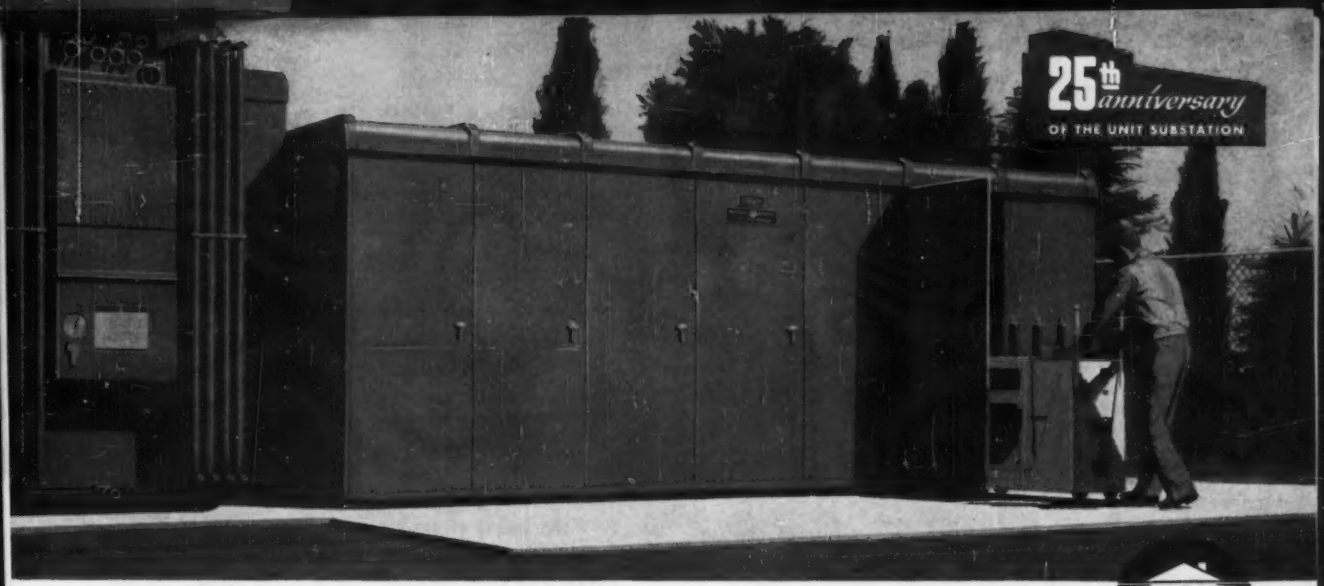
3 Sam's Mobile Unit Substation, dubbed the "Utility Fire Engine," appeared on the scene....

4 In "39, Sam found industry still "buying a carload of copper" to distribute plant power....

6 Sam moved his Substation underground—helped eliminate drudgery, speed mine electrification.

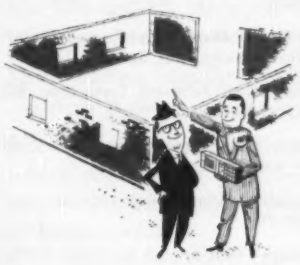
7 Sam's Control-Center Substation helped speed mechanization and automation in industry.

8 Buildings big or small rely on Sam's Load-Center Unit Substations.



LIVE BETTER ELECTRICALLY

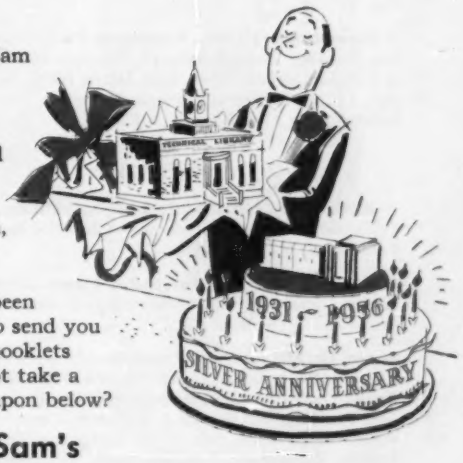
with General Electric Unit Substations



5 The introduction of Load-Center Unit Substations meant "More Power to America..."

9 Sam's Substation has "taken root." His influence affected numerous product developments.

THIS YEAR, Substation Sam has joined the Quarter Century Club. His first Unit Substation has completed 25 years of continuous service. To celebrate the occasion, an outstanding "Silver Anniversary Technical Library" has been prepared and we'd like to send you copies of the handsome booklets that make up it. Why not take a minute to fill out the coupon below?



Have you seen Sam's Silver Anniversary Technical Library?

Section A512-15
General Electric Co.
Schenectady 5, N. Y.

Please send me, without charge, copies of the booklets that make up your Silver Anniversary Technical Library on Unit Substations.

NAME .....

COMPANY NAME .....

ADDRESS .....

CITY ..... STATE .....

Progress Is Our Most Important Product

GENERAL ELECTRIC

MEETINGS CALENDAR

JANUARY, 1957

Northeastern Weed Control Conference — Sheraton-McAlpin Hotel, New York City, Jan. 10-12.

Doble Engineering Co—24th Annual Conference of Doble Clients, Sheraton-Plaza Hotel, Boston, January 14-18.

Edison Electric Institute—Industrial Relations Committee, sponsored jointly by personnel section of Southeastern Electric Exchange, Sheraton-Park Hotel, Washington, D. C., Jan. 17-18; Industrial Power & Heating Group, New Orleans, La., Jan. 17-18.

Southeastern Electric Exchange—Personal Administration Section Meeting, held jointly with EEI, Sheraton-Park Hotel, Washington, D. C., Jan. 17-19.

• **Atomic Industrial Forum, Inc**—Forum Insurance Meeting, final report of the Forum-sponsored Columbia University study on "Financial Protection Against Atomic Hazards," Plaza Hotel, New York, N. Y., Jan. 21-22.

American Institute of Electrical Engineers—Winter General Meeting, Hotel Statler, New York, Jan. 21-25.

American Welding Society—Illinois Institute of Technology—3rd Annual Midwest Welding Conference, Illinois Tech Chemistry Bldg.; Chicago, Ill., Jan. 30-31.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, Hotel President, Kansas City, Mo., Jan. 31-Feb. 1.

• **Pennsylvania Electric Association**—Prime Movers Committee, Roosevelt Hotel, Pittsburgh, Pa., Jan. 24-25; Transmission & Distribution Committee, Penn Harris Hotel, Harrisburg, Pa., Jan. 31-Feb. 1; Hydraulic Power Committee, Brunswick Hotel, Lancaster, Pa., Jan. 31- Feb. 1.

FEBRUARY

• **Ninth Annual Industrial Engineering Institute**—University of California, simultaneous sessions in Berkeley and Los Angeles, Feb. 1-2.

National Association of Purchasing Agents—26th Annual Mid-Winter Conference, Public Utility Buyers' Group, Brown Hotel, Louisville, Ky., February 3-5.

Edison Electric Institute—Prime Movers Committee, Deschler Hilton Hotel, Columbus, Ohio, Feb. 4-6; Transmission & Distribution Committee, Netherland Plaza Hotel, Cincinnati, Ohio, Feb. 7-8; Electrical System & Equipment Committee, Somerset Hotel, Boston, Mass., Feb. 11-12; Commercial Cooking & Water Heating Committee, Tutwiler Hotel, Birmingham, Alabama, Feb. 14-15.

• **Pennsylvania Electric Association**—Electrical Equipment Committee, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 7-8; Communications Committee, Hotel Americus, Allentown, Pa., Feb. 11-12; System Planning Committee & Systems Operation Committee, Philadelphia, Pa., Feb. 14-15; Relay Committee, Roosevelt Hotel, Pittsburgh, Pa., Feb. 28-Mar. 1.

National Electrical Week—Second Annual Observance, Feb. 10-16.

Electric Institute of Washington—Electrical Trade Conference & Exposition, Shoreham Hotel, Washington, D. C., Feb. 12-14.

• **National Electrical Manufacturers Association**—General Purpose Control Subcommittee, Advisory Committee, Industrial Control Section and Industry Control Subcommittee, Advisory Committee, Industrial Control Section, Feb. 13; Electronic Control Subcommittee, Advisory Committee, Industrial Control Section and Standards Committee, Advisory Committee, Industrial Control Section, Feb. 14—all being held at NEMA Headquarters, 155 East 44th St., New York, N. Y.

American Institute of Electrical Engineers—1957 Transistor & Solid State Circuit Conference, sponsored jointly with Institute of Radio Engineers and University of Pennsylvania, University of Pennsylvania, Philadelphia, Pa., Feb. 14-15.

National Society of Professional Engineers—Spring Meeting, Hotel Francis Marion, Charleston, S. C., Feb. 15-16.

13th Annual National Adequate Wiring Conference—Sherman Hotel, Chicago, Ill., Feb. 21-22.

• **North Central Electrical League**—20th Annual Upper Midwest Electrical Industry Convention, Leamington Hotel, Minneapolis, Minn., Feb. 24-27.

Institute of Radio Engineers—Western Joint Computer Conference, Hotel Statler, Los Angeles, Calif., Feb. 26-28.

American Society of Heating and Air-Conditioning Engineers—63rd Annual Meeting, Chicago, Ill., Feb. 25-28.

Pacific Coast Electrical Association—Business Development Section, Sheraton-Palace Hotel, San Francisco, Calif., Feb. 28-Mar. 1.

MARCH

Southern Safety Conference—John Marshall Hotel, Richmond, Va., Mar. 3-5.

Louisiana State University—Annual Conference on High-Speed Computers, Baton Rouge, La., Mar. 5-8.

• **Engineers Joint Council**—(in coordination with 20 engineering and scientific societies) 2nd Nuclear Engineering and Science Conference; 3rd International Atomic Exposition; 5th Hot Laboratories and Equipment Conference, Convention Hall, Philadelphia, Pa., Mar. 11-15.

Northwest Electric Light & Power Association—Business Development Section, Empress Hotel, Victoria, B. C., Mar. 18-20.

Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York City, Mar. 21.

Pacific Coast Electrical Association—Engineering & Operating Section, Hotel Statler, Los Angeles, Mar. 21-22.

Oklahoma Utilities Association—Annual Convention, Tulsa Hotel, Tulsa, Okla., Mar. 28-29.

Illinois Institute of Technology—19th Annual American Power Conference, Hotel Sherman, Chicago, Ill., Mar. 27-29.

APRIL

Southeastern Electric Exchange—Annual Meeting, Boca-Raton Hotel, Boca Raton, Fla., April 1-3.

Missouri Valley Electric Association—Engineering Conference, Hotel President & Municipal Auditorium, Kansas City, Mo., April 3-5.

Edison Electric Institute—Main Accounting Conference held jointly with AGA, Washington, D. C., April 8-10.

American Society of Mechanical Engineers—Spring Meeting, Birmingham, Ala., April 8-10.

• **American Welding Society**—Fifth Welding Show, Convention Hall, Philadelphia, Pa., April 9-11.

Agricultural and Mechanical College of Texas—Tenth Annual Conference for Protective Relay Engineers, College Station, Texas, April 15-17.

Pacific Coast Electrical Association—Administrative Services Section, Hotel La Playa, Carmel, California, April 24-25.

• Additions this week

"I'll be right down, Joe... These PLP DEAD-ENDS are a cinch to install"...

Installation of a PLP Dead-End is no trick at all. It's fast and it's done right the first time, by hand. No need to recheck later.

The resulting installation is neat . . . safe . . . permanent.

The streamlined appearance speaks for itself. Safety is assured because there are no sharp edges, no concentrated stress or fatigue point.

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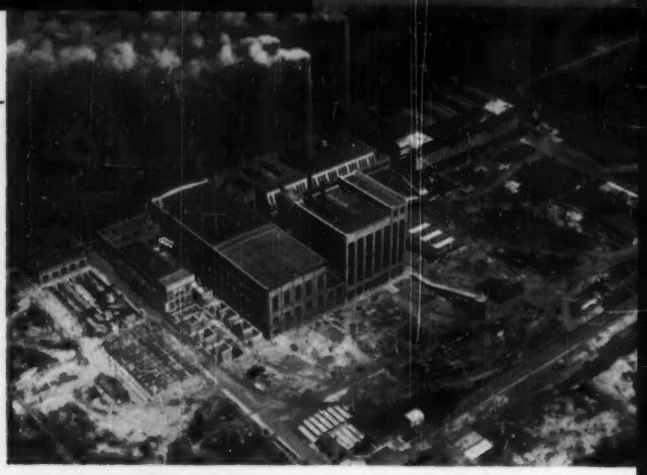
Belgian Plant Burns Heavy Oil Residues



Schelle power station 25 miles down-river from Antwerp burns oil refinery fuels that are stiff asphaltic tars at 60F. Fuel delivered in insulated barges

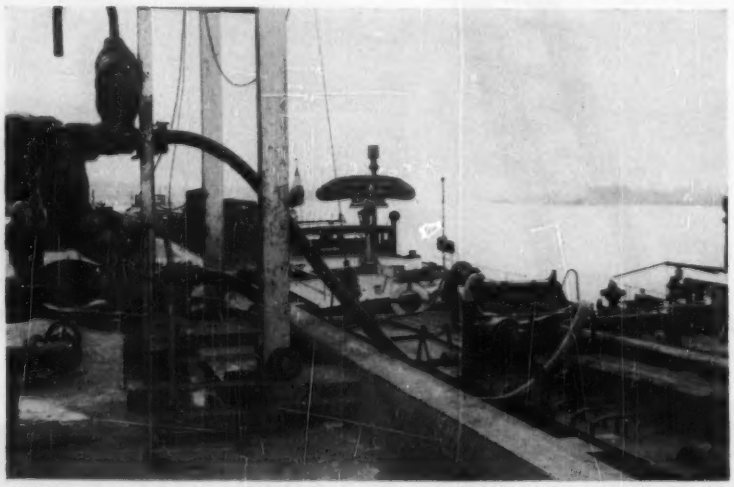
ALFRED DUFRASNE, Consulting Engineer, Cie General d'Entreprises Electriques & Industrielles, Brussels, Belgium

Two Belgian steam generating power plants have been operating for some time with petroleum residues having very high viscosities. The first is in the steam generating section of the refinery of La Societe Industrielle Belge des Petroles, producers of the residues as by-products of their petroleum product. The second is in the power station of La Societe General Belge d'Electricte at Schelle in the province of Antwerp.

Schelle is situated at the confluence of the Schelde and Rupel Rivers, about 25 miles from the city. The station is on the Schelde's bank, advantageously located to obtain its fuel from the petroleum refineries in Antwerp. It is reported that the station has been using a range of products from the refineries that have viscosities varying from 3,000 to 3,500 SSF/210F. To appreciate this, it is necessary to realize that at 60F they have the consistency of a stiff tar!

In the U.S., the El Segundo Station of the Southern California Edison Co uses oil refinery residues with viscosities in the order of 1,500 SSF/210F (EW, Oct. 31, 1955, p 72).

Schelle Station is rated 250 Mw, 150 Mw high pressure generated and 100 Mw low pressure. Five boilers, originally designed for coal and used with low pressure turbine-generator units, were modified to burn the heavy residues.



INSULATED BARGE is shown alongside dock at Schelle power station. Lines are connected, ready for discharging. Note radar antenna on barge deckhouse roof

The asphaltic residues are delivered to the dock of the refinery at approximately 320F. From there they are transported to the power station in barges. These are 128 ft long, 15½ ft wide, and have a carrying capacity of 275 tons. Three removable, very carefully insulated tanks are in the barge hold. Limited space precluded reheating the fuel in these tanks.

Two transfer pumps are in the barge engine room. One is operated by a power take-off from the diesel propulsion plant, the other by an electric motor with power supplied from the dock. Supply pipes are located on deck; those used for discharge are sunk into the tanks. All valves and pumps are steam traced.

In practice it has never been necessary to reheat the residues prior to discharging them from the barge. Loading, trip, and discharge times from the refinery to the power station total about five hours. This relatively short time, combined with the excellent insulating characteristics built into the barge, have resulted in a temperature drop that has never exceeded 5.5F, even under the most rigorous weather conditions. The rate of discharge from the barge is approximately 220 tons per hour.

In addition, the barge is equipped with radar and ship-to-shore radio for communication with the refinery, power station, and port authorities.

Upon arrival at the power station (see Figure 1), the residues are discharged from the barge to two 1,000-

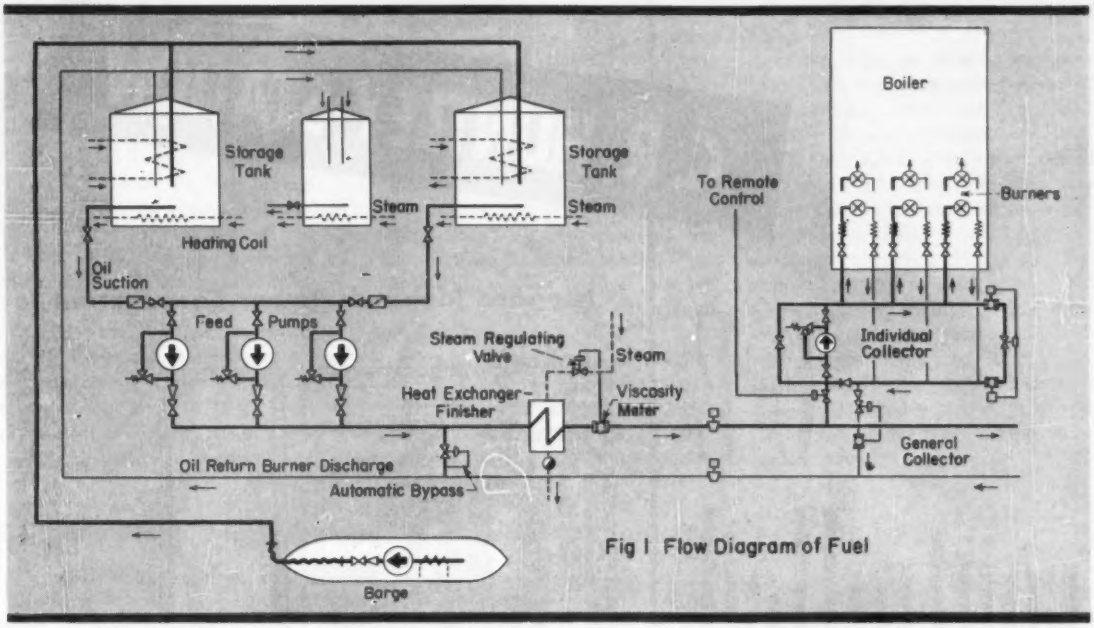


Fig 1 Flow Diagram of Fuel

FUEL must be kept hot as it is pumped from the transporting barge through heating coils, feed and booster pumps, heat exchanger, viscosity regulator, individual and general collectors . . . all necessary before it goes to the burners

cu meter tanks. These tanks are maintained at a minimum temperature of 330F by an appropriate steam heating system. Three helical rotary, steam-jacked pumps, operated in parallel two at a time, provide suction on the tanks, drawing the heavy oil through heating filters. A heat exchanger-finisher brings the oil to the required viscosity of 15 SSF to permit mechanical spraying at the burners.

Oil lines were run to avoid low points and to obviate dead ends. Piping sizes are such that at no point in the lines does flow exceed 3 ft per sec. Here too, all lines are steam traced. Keeping the lines hot adds to the overall efficiency of the system. In this manner, temperature drops have been limited to 1F, and it is possible, after a reasonable time, to melt residues that have solidified accidentally or during a shutdown. Lines can also be rinsed with light fuel oil.

The principal characteristics of the pumps and heat exchanger are detailed as follows:

Pumps:

Type: Double helical rotary, steam-jacketed

Capacity: 110 gal per min

Discharge Pressure: 225 psi

Max Temp of Residue: 425F

Max permissible viscosity: 275 SSF

(*Continued on page* 51)

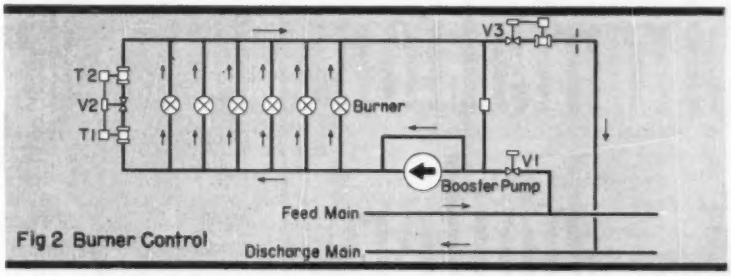


Fig 2 Burner Control

CONSTANT PRESSURE AND VISCOSITY of fuel are among requirements for high boiler efficiency. Valves and transmitters provide the most suitable conditions

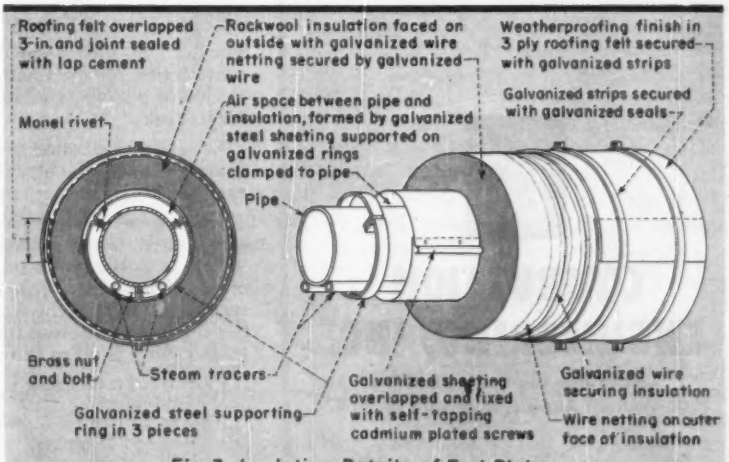

Roofing felt overlapped 3-in. and joint sealed with lap cement
Rockwool insulation faced on outside with galvanized wire netting secured by galvanized wire
Weatherproofing finish in 3 ply roofing felt secured with galvanized strips
Galvanized strips secured with galvanized seals
Monel rivet
Air space between pipe and insulation, formed by galvanized steel sheeting supported on galvanized rings clamped to pipe
Pipe
Brass nut and bolt
Steam tracers
Galvanized sheeting overlapped and fixed with self-tapping cadmium plated screws
Galvanized wire securing insulation
Galvanized steel supporting ring in 3 pieces
Wire netting on outer face of insulation

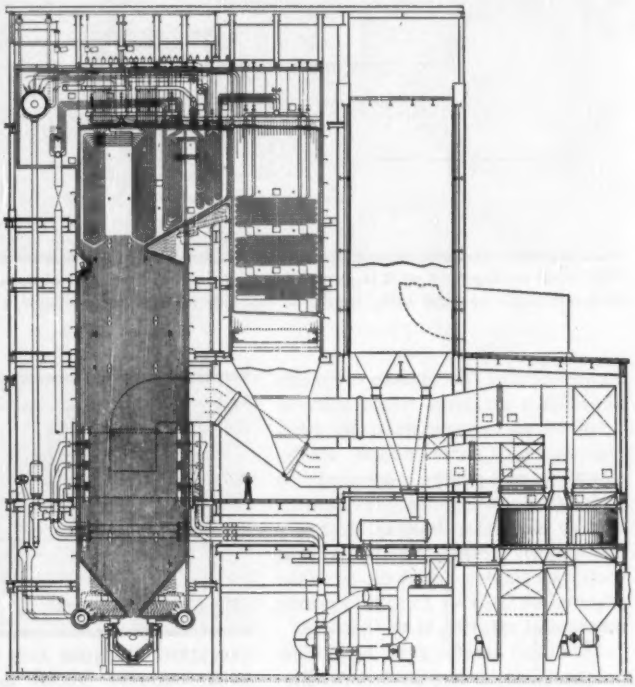
Fig. 3 Insulation Details of Fuel Piping

STEAM TRACING of the fuel piping results in the reduction of heat losses and increase in the over-all efficiency of system. Temperature drops are limited to 1F

C. R. HUNTLEY STATION

Niagara Mohawk Power Corporation

C-E controlled circulation boilers



The C-E Unit shown above, one of two duplicates, is presently under construction for the Charles R. Huntley Steam-Electric Generating Station of the Niagara Mohawk Power Corporation at Tonawanda, New York.

Each of these boilers is designed to serve a 200,000 kw turbine-generator operating at a throttle pressure of 2400 psig with a primary steam temperature of 1050 F, reheated to 1000 F.

They are of the controlled-circulation, radiant reheat type with a separated (twin) furnace arrangement. Secondary superheater surface is at the outlet of one furnace and reheater surface at the outlet of the other. Primary superheater sections and economizer surface follow both the secondary superheater and reheater surfaces. Regenerative air heaters follow the economizer surfaces. The section shown above is taken through the superheater furnace.

Pulverized coal firing is employed, using bowl mills and tilting, tangential burners.

B-973

C-E

COMBUSTION ENGINEERING, INC.

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

STEAM GENERATING UNITS; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; HOME HEATING AND COOLING UNITS; DOMESTIC WATER HEATERS; SOIL PIPE

350-Mw Wind Tunnel (*Continued from page* 25)

each supporting three single-conductor, 500-MCM, oil-filled, paper-insulated, 138-kv cables. The four circuits are capable of carrying a total of 400,000 kva. Together with the existing 130,000-kva, 34.5-kv system in surface ducts, this provides cable capacity to carry 530,000 kva.

The 34.5-kv tertiary windings of the four 70,000-kva transformers are cabled to NACA's 34.5-kv Substation G. There the tertiaries are paralleled on two buses and interconnected with the original 34.5-kv system. This cable is three-conductor, 750-MCM, low-pressure, gas-filled, paper-insulated.

To minimize the amount of 6,900-v cable, the four transformers were placed as close to the motors as possible. Each motor had a full-load current of about 3,000 amp, but metal-clad switchgear and breakers were available only for 2,000 amp. Consequently, two breakers were required per motor. To improve current division between the two breakers, the stator winding was divided into two circuits and brought out on separate terminals.

Each of these circuits was cabled to the breakers by three 2,500-MCM annular single-conductor cables. These varnished-cambric-insulated, aluminum-interlocked-armored cables were supported on wooden insulating blocks and aluminum cable racks. For the secondary drive motors, 2,000-MCM cable was sufficient.

All other 6,900-v loads were cabled with varnished-cambric-insulated, aluminum-interlocked-armored cable supported on aluminum racks and run in tunnels between buildings. The armor eliminated need for conduit and allowed use of smaller copper cross section because of good ventilation.

Every portion of the NACA power system above the 2,400-v level is provided maximum protection by differential relaying with selective overcurrent back-up relaying.

Belgium Plant Burns Residues (*Continued from page* 49)

Number: 3, operating 2 at a time, in parallel

Heat Exchanger:

Type: Floating head

Over-all length: 22.8 ft

Shell diam: 2.9 ft

Heating surface: 2,140 sq ft

Capacity: 3,270,000 Btu per hour

Temperature: Inlet—315F; Outlet —420F

At the boiler a booster pump increases the oil pressure to 426 psi to an individual collector on which there are six burners in parallel. They have been mounted on the rear wall of the combustion chamber which has not been modified in any other way. Coal-burning equipment has been left undisturbed.

Each burner has a flow rate of 1.1 tons per hour. Unused fuel is returned to a general collector at the same rate of flow, maintaining the temperature of the individual collector. Uniform operation requires constant fuel viscosity and pressure at the burners. Controls have been provided to assure this.

Pressure in the main collector is regulated by a pneumatic valve which bypasses the excess of fuel before it goes to the heat exchanger-finisher. Viscosity is regulated by a regulator at the discharge side of the heat exchanger-finisher. When the viscosity of the fuel from the heat exchanger-finisher varies, the regulator actuates another pneumatically operated valve which either increases or decreases the steam supply to the heat exchanger-finisher, thereby tending to keep the viscosity of the fuel constant.

A method has been worked out at the boiler itself to maintain automatically suitable spraying to cope with any variation in fuel pressure caused by a change in boiler output. In Fig 2, the boilerman operates valve V1 which regulates the supply and return pressures in the burner loop. The difference of these pressures is kept constant by the complex nature of valve V2 which in turn is actuated by transmitters in the supplying and return lines (T1 and T2, respectively). The burners, therefore, are operated under optimum pressure conditions. Their flow depends upon pressure in the head of the burner, that is, in the return line. Limiting the rate of flow in this line is accomplished by valve V3 which restricts flow to the collector of at rate of approximately 1.1 tons per hour.

Thus modified, each burner is said to have a daily trouble-free production of 1,100 tons. Performance, compared to that of coal firing prior to modification, has reportedly improved by about 4%. This increase is attributed largely to elimination of unburnt losses. CO_2 content in the smoke before the air heater is between 11 and 12%; the stack temperature varies between 392 and 410F. Air flow through the ducts of each burner is approximately 15.4 lb per sec and superheater temperature has remained unchanged.

The plant operators claim that the pressure differential between supply to and return from the burners has relatively little effect on fuel atomization.

Steam Plant, Power Pool Planned by Three Utilities

Joint construction of a steam power plant to be built near Yuma, Arizona, and plans for formation of a power pool have been announced by California Electric Power Co, Arizona Public Service Co, and the El Centre (Calif.) Imperial Irrigation District.

The first 80,000-kw unit for Yuma Axis steam plant, to be installed by Calectric, will be started next year for completion in the spring of 1959. APS will add the second 80,000-kw unit for probable 1962 operation. A third unit of similar size is being contemplated by Imperial for 1963 or 1964 completion.

APS will operate the $50-million plant and the three contracting agencies will participate in output and share all costs on the basis of participation.

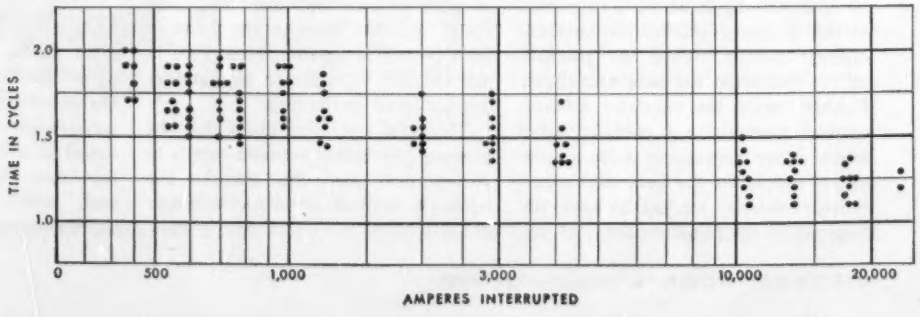
The interconnected system will include all territory and loads served by Imperial, the Yuma area of APS, and Calectric's Palo Verde and Mexicali loads. Bureau of Reclamation lines will be interconnected.

Helps Lure Industry

Arkansas Power & Light Co and other public utilities in the state have agreed to put up $1-million for the organization of a private industrial corporation as part of a unique plan aimed at attracting new industries to the state. The plan provides that each utility would contribute the money according to its income.

Proved again the fastest, most efficient principle of arc extinction ever devised . . . Above, the exclusive Westinghouse De-ion® arc interrupter in action. One of the features that makes possible the many advancements and leadership of Westinghouse-designed breakers.

Results of typical interrupting tests with the new 50-DHHS air breaker . . . several hundred interruptions, 500 to 30,000 amps, interrupted within two cycles.



Westinghouse paces industry needs with

fastest operating air breakers available

Your present and future needs in air circuit breakers are assured by recent Westinghouse developments. In a move to keep a jump ahead of utilities requirements in basic circuit protection, Westinghouse has developed a series of new ratings in air circuit breakers for use in metal-clad switchgear.

These metal-clad breakers cover important utility applications including 4-kv distribution circuits, large metropolitan substations and generating station auxiliary power needs.

New ratings have been added to the standard line of Westinghouse 5-cycle breakers. The breakers described below, featuring new interrupting ratings and times, have behind them the outstanding experience and reliability of Westinghouse plus exhaustive tests in our own high-power laboratories.

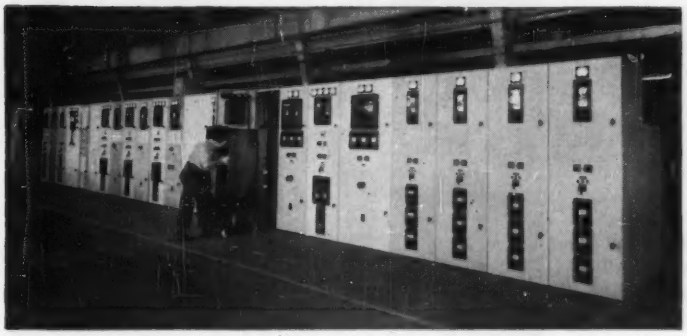
NEW 50-DH-75 BREAKER . . . Rated 75-mva interrupting capacity, 4.16 kv, 1200 amperes continuous, 5-cycle rated interrupting time.

NEW 150-DH-750 BREAKER . . . Rated 750-mva interrupting capacity, 13.8 kv, 1200 or 2000 amperes continuous, 5-cycle rated interrupting time.

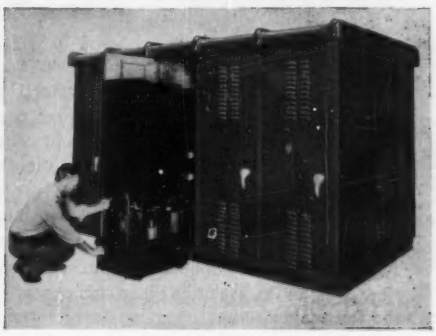
NEW 50-DHHS BREAKER . . . The new 2-cycle, high-speed breaker for 4.16-kv distribution circuits. Reduces wire burn downs and annealing. Rated 30,000 amperes interrupting capacity at 4.16 kv, 600 amperes continuous, 40,000 amperes momentary, 2-cycle rated interrupting time.

NEW 50-DH-350 BREAKER . . . Rated 3000 amperes continuous, 350-mva interrupting capacity, 4.16 kv, 5-cycle rated interrupting time. For heavy-current circuits.

Call your Westinghouse sales engineer or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60891-X



Standardized convenience . . . draw-out feature with this 50-DH-350 breaker, as with all Westinghouse air breakers, means quick, foolproof replacement, maximum accessibility.



150-DH-750 air breaker for outdoor metal-clad switchgear in a large metropolitan substation.

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

CLASS IS OUT, but these engineering students are headed for a campus drafting room set up by Consumers Power Co

UNDER SUCHE'S watchful eye, engineering students work on substation designs, relieving Consumer's staff draftsmen

Students Turn Out Substation Designs

Consumers Power Co has engaged eight students of the Michigan State University college of engineering for substation design work. This takes some of the load off Consumers' staff draftsmen and allows the eight students to apply their classroom theories while they continue their school work.

The plan also provides financial assistance for the students where, in some cases, it is much needed. It helps the students to continue their education and enables married students to maintain their campus apartments during the summer without having to leave town for a job.

During the school year this drafting unit functions Tuesday and Thursday afternoons and all day Saturday. Through the summer it operates on a full time schedule, except for the students who are attending summer school. They work half weeks.

There were 45 applicants for the seven jobs when the project was launched. There is no stipulation that the men must work for Consumers after graduation. To qualify for the work, they must be bona-fide engineering students. Ability, as evidenced by scholastic performance, is a major consideration.

Eddie Suche of Consumers' Jackson (Mich.) office supervises the work of the group. He divides his time between the Jackson office and East Lansing.

STUDENTS BENEFIT at least three ways: They make money, gain experience, and keep campus apartments in summer

'Housepower' Winner Gets $10,000

Mary M. Brown smiles approvingly as she receives a check for the $10,000 first prize in the national "How Is Your HOUSEPOWER" contest sponsored by EEI. Mrs. Brown, whose entry was judged best among more than 316,000 received during the 5-months contest, says she plans to use the money for her family and her home.

The check was presented at the Electric Living Center of Philadelphia Electric Co. Shown with Mrs. Brown are, l to r, M. I. Allen, vice president, Philadelphia Electric Co; Frank Kitzmiller, EEI HOUSEPOWER Program Manager, and George E. Whitewell, president, Philadelphia Electric Association.

LBE to Get Woman's Touch

The Live Better . . . Electrically program, having rounded out its first year in which, not so incidentally, it was pretty successful, will get an even greater impetus when the women lend a hand in it in '57.

At least that's the idea behind the LBE Women's Conference to be held at the Edgewater Beach Hotel in Chicago on Thursday and Friday, January 10 and 11. The conference is being planned by EEI's Home Service Committee to meet the interests of home service women, equipment company home economists and magazine editors. It is set up as a two-day meeting plus a planned tour of the Chicago Merchandise Mart on Saturday, January 12.

Highlights of the program will include talks by equipment editors discussing special magazine sections and editorial features, with the emphasis on how to use them for maximum benefit in working with customers. Home economists with appliance manufacturers and food processing companies will tell the group about their part in the national program and of the assistance offered by their firms.

There will also be a session devoted to ideas for demonstrations; others for home lighting, electric kitchens, electric washers and dryers, and still another for adequate wiring.

Utilities, manufacturers, distributors and others will do well to send their lady representatives. Use a lady to sell a lady!

EEI Issues Data on Commercial Cooking

A new series of Commercial Electric Cooking Data Sheets—12 case studies on electric success stories of commercial electric cooking installations—has been prepared by EEI's Commercial Electric Cooking and Water Heating Committee.

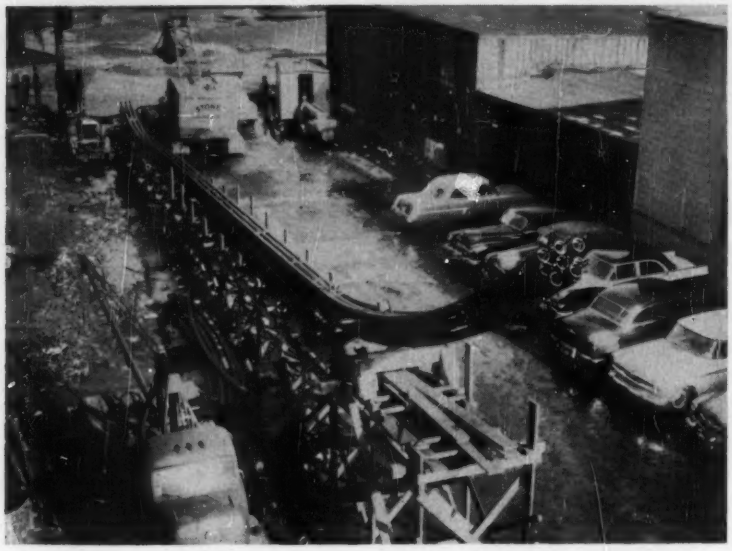
Data sheets were compiled by utilities and highlight the ease, efficiency and economy of electric cooking equipment in both new and converted installations. They offer plenty of facts for selling architects, general contractors, designers and food service operators.

The new series, No. 61 through No. 72, is available from Commercial Department, Edison Electric Institute, 420 Lexington Avenue, New York 17, N. Y. Price: $4.00 for the first set, $1.00 for the next nine, and 50¢ for each additional set thereafter. 10% additional for non-members of EEI. Prices apply to each order sent to one address.

Lighting Bureau Notes

Highly favorable comments upon the results gained through the operation of Certified Lighting programs were voiced by the operators of local lighting bureaus, in two recent meetings. One occasion was the annual meeting of the Executive Committee of the National Lighting Bureau in Boston; the other meeting was the first annual conference of managers of the Certified Lighting Program in Detroit. A release covering the two meetings is available from the NLB, 155 E. 44 St, New York 17, N. Y.

In a report of the progress which has been made by the three-year old Certified Lighting Program, Bureau Manager Laurence C. Messick told of the 18 bureaus now in operation and of the 672 certified lighting jobs with a total of 33,636 fixtures and a 6,153-kw load which had been installed. He also pointed out that on the basis of an EEI survey, "lighting represented 25.5% of utilities' kwhr sales, and at the same time accounted for 33% of total utility revenue. As of July 31, 1956, utilities were serving over six million commercial customers; if one additional kw were sold to each of these customers, utilities could expect an additional annual revenue of $284 million. Messick also claims that utilities do not have an adequate salesman corps to capitalize on the lighting load acceptance their promotions build.



WEPCO 'Pipes' Power Under River

Using 5-in. diameter special corrosion-resistant wrought iron pipe produced by A. M. Byers Co of Pittsburgh, Wisconsin Electric Power Co is completing a 7,200-ft cable crossing project under the Wisconsin River. The cable will serve the city's heavily industrialized south side. The pipes are laid in trenches in the river bottom with no protection other than the backfill over them. Buried armored cables were used in the past.

Aluminum Supply in 1956 Brought to Demand Level

During 1956 the aluminum industry, through its continuing program of expansion, brought supply of the metal up to the level of demand. As a result, aluminum now is freely available for many new uses, reports Donald W. White, secretary of The Aluminum Association, New York.

White said that despite losses in the second half of the year because of strikes, U. S. primary aluminum production in 1956 is expected to reach a total of about 1,682,500 tons, or about 7.5% over the record primary production in 1955. This will be the fifth year in succession that the industry has set a new primary production record.

With the new capacity scheduled for completion in 1957, industry leaders are predicting total shipments of over two million tons of aluminum products during the new year.

Primary aluminum producers increased their annual capacity by more than 125,000 tons in 1956 so that at year-end their total capacity stands at 1,762,200 tons per year, the Association secretary reports. Additional facilities now under construction will increase the industry's primary capacity by about 42% during the next two years. Included are four new reduction plants, two of which are being built by new producers. (It takes two tons of alumina to produce one ton of aluminum. Each pound of metal produced requires about 10 kwhr).

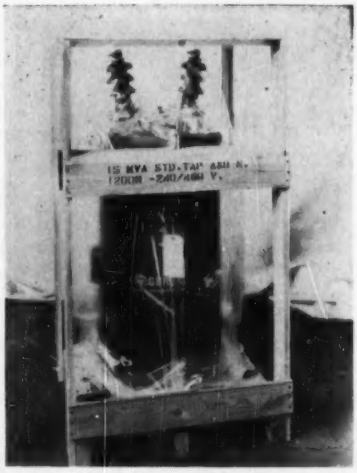
Sec. White noted that marked increases have been registered in shipments of aluminum wire and cable for electrical use—the 9-month totals showing ACSR and bare cable up 21.3%, bare wire up 77.4% and insulated wire and cable up 49% over the corresponding months of 1955.

For the month of November primary aluminum production in U. S. totaled 145,081 tons. This is a decrease of over 4,000 tons from 149,125 tons produced in October, but an increase of almost 11,400 tons over November 1955. Total production for the year through November was 1,530,856 tons, or 105,819 tons more than the 1,425,037 tons for the same period in 1955.

Westinghouse Ships Computer to West Penn

Westinghouse Electric Corp has shipped an economic dispatch computer to West Penn Electric Co. When it goes into operation early in 1957, it will compute the dispatch of the entire West Penn Electric system. This system, made up of three principal operating companies — West Penn Power Co, Monongahela Power Co and Potomac Edison Co—has a peak load of 1,440 Mw and covers 29,000 sq miles.

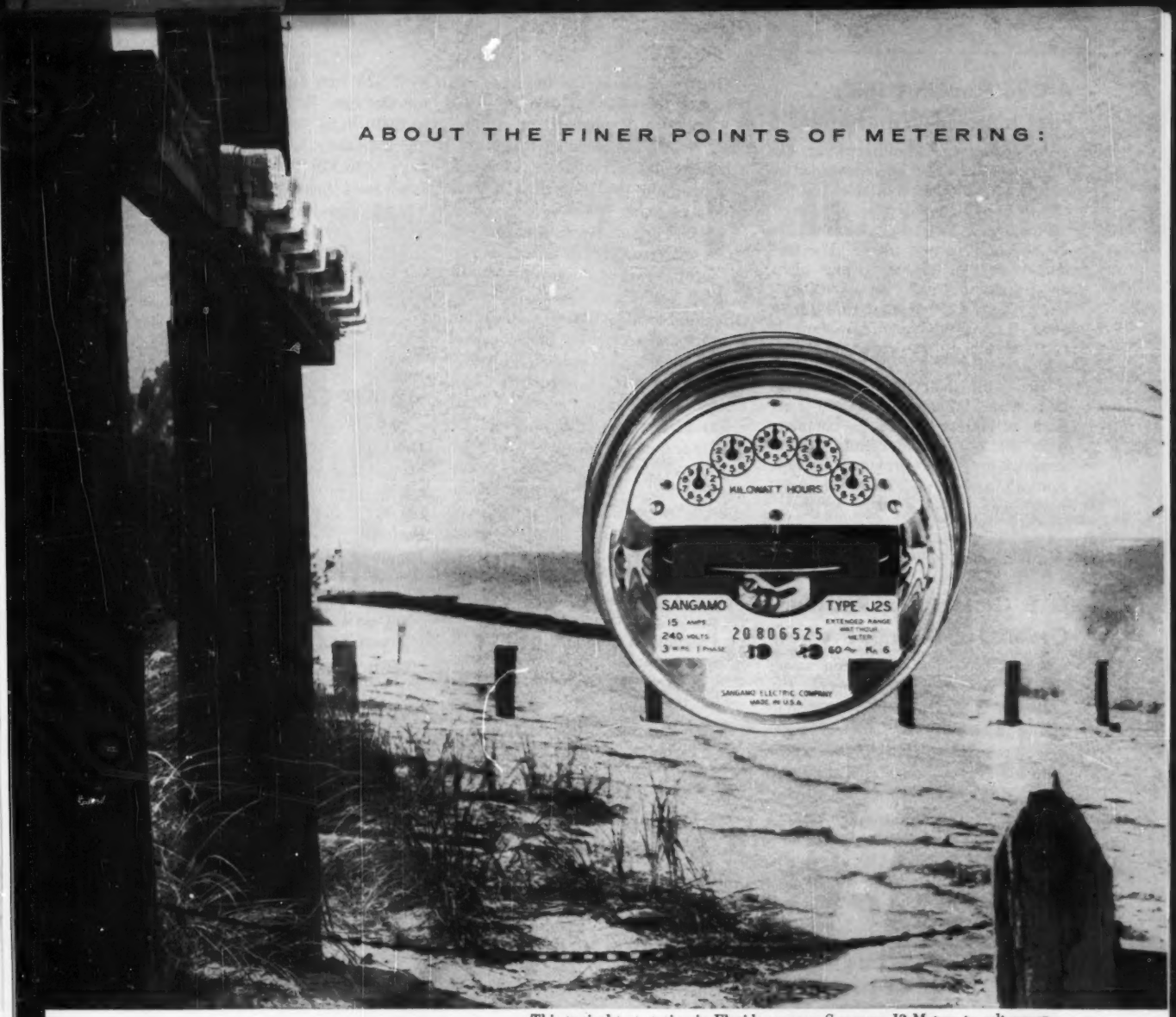
Westinghouse estimates the computer can save utilities as much as $50,000 a year per 1,000 Mw of generation by computing the most economic dispatch. In addition, it should simplify the work of the dispatcher.



"SUPERMARKET" PROTECTION. Just as transparent polyethylene bags are used to keep food fresh from supermarket to table, so Gardner Transformer Division of Federal Pacific Electric Co is using them to keep their power distribution transformers fresh until they are delivered to the utility or substation. Transformers with ratings up to 50 kva are shipped in the bags.

(*More M & M on page 58*)

ABOUT THE FINER POINTS OF METERING:



This typical test station in Florida exposes Sangamo J2 Meters to salt vapor atmospheres as part of Sangamo's continuous program of improvement.

Field tests prove corrosive atmospheres can't hurt J2 Meters

Longer meter life—even under the worst possible service conditions—is the subject of constant study and research at Sangamo.

The findings of continuous field tests since 1952 at salt atmosphere test stations on the coasts of California—Texas—Florida . . . corrosive industrial atmosphere stations in chemical industry areas, are the basis of the corrosion-resistant design of the J2.

All external and internal meter parts are given complete protection against all conditions of outdoor exposure. The use of rust inhibitors, oxide films, inorganic seals and special plating on all metal parts and the inert organic Selkyd meter base assure many years of maintenance-free service under the toughest conditions.

And remember, the J2 Meter is the *slow speed* meter—only 10 revolutions per minute at full nameplate rating—another reason why the J2 is your best investment in a watthour meter.

Live Better Electrically

SANGAMO

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

JM56-7

A-C to Furnish USBR's First Impulse Waterwheel

Allis-Chalmers Manufacturing Co reports that it has been awarded a contract for the first hydraulic turbine of the impulse type to be purchased by the U. S. Bureau of Reclamation for any of its power plants. The turbine is for the Green Springs plant on Emigrant Creek near Ashland, Ore., where a head range of 1700 to 1985 ft is available. This plant is part of the Bureau's Rogue River Basin project.

The Allis-Chalmers 4-jet, vertical unit, rated 23,500hp under 1800-ft net head at 600 rpm, will be complete with oil pressure governor and a penstock pressure-operated rotary type shut-off valve. The unit is scheduled for shipment late in 1957.

G E Germanium Rectifiers Ordered by Diamond Alkali

Installation of a germanium power rectifier system rated at 35,000 kw, 250 v dc, is to be made by Diamond Alkali Company at this chemical producer's Deer Park plant near Houston, Texas. General Electric Co received the order for the equipment.

The system is said to be the nation's largest and the first U. S. sale at a voltage rating above 150. Diamond Alkali will use the equipment to provide direct current to a chlorine cell installation. The facility is expected to be put in operation in early 1958.

General Electric Co has also reported on the following developments:

- Technical Products Dept at Syracuse, N. Y., has initiated training of a nation-wide service force to install and maintain the company's closed-circuit television systems.
- Gas Turbine Dept, Schenectady, N. Y., has received an order for two gas turbine-generator sets with a combined capacity of 33,000 kw from Orlando, Florida Utilities Commission.
- Announcement by the Chemical and Metallurgical Division, Pittsfield, Mass., of a sale of a portion of its interests in the manufacture of alkyd resins to Archer-Daniels-Midland Co of Minneapolis.
- Installation of a modern communications system along Massachusetts' new east-west turnpike by the Communications Dept, Syracuse, N. Y.
- General Electric Co's Lamp Division at Cleveland has halted, for an indefinite period, construction work on a $2 million lamp lead and research laboratory, and the start of construction of a $3 million lamp glass research laboratory, However, work on other projects is going ahead—on a $5 million Lamp Development Laboratory at Nela Park and a $1.5 million quartz plant.

U. S. Copper Production

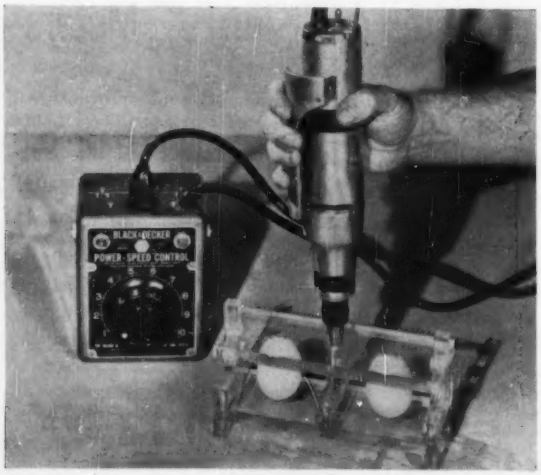
Primary copper production in U. S. during November amounted to 90,084 tons, according to The Copper Institute, New York. This is a decrease by 5,025 tons from the 95,109 tons for October. Refined production was 132,970 tons for November, down approximately 3,400 tons from October's 136,379 tons. Deliveries to fabricators increased 1,171 tons, to 114,524 tons in November up from 113,353 tons in October. Refined stocks at the end of November amounted to 116,516 tons, an increase of 10,396 tons over the October amount.

NNS&D Co Gets Contract

Newport News Shipbuilding and Drydock Co, Newport News, Va., has been awarded a $608,750 contract to install two hydro-electric turbines for the Fremont Canyon power plant in central Wyoming. The Bureau of Reclamation contract calls for installation of two 33,500-hp vertical shaft hydraulic turbines for the Fremont plant on the North Platte River. It is a part of the Glendo Dam unit.

330-Kv Cables by BICC

British Insulated Callender's Cables, Ltd, is supplying 330-kv cables for Kariba hydro project as part of $9.8-million order. Cables will connect underground power house to overhead transmission via a 525-ft deep vertical shaft. Three circuits each with three single-core 330-kv oil-filled cables will be provided. Each will have 1,500-kv impulse level and 500-amp rating.

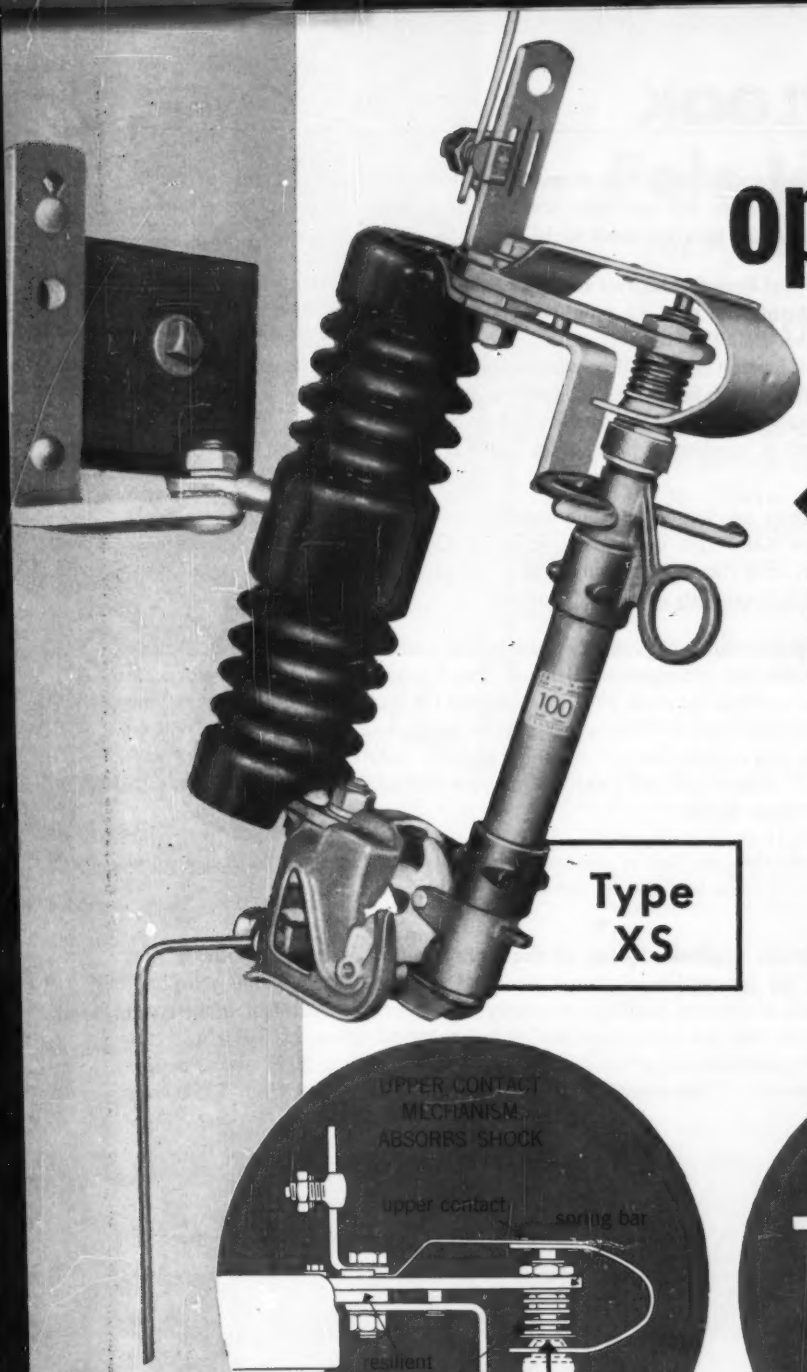


Screwdriver Gentle on Eggs

The reported versatility of its new electric power-screwdriver is being demonstrated by Black & Decker Mfg Co in a very unusual way. With the right combination of clutch adjustment and speed control, the operator uses the "Scrugun" to tighten a center screw, which draws two plastic panels together. The panels come together until they hold two eggs firmly in place, but do not crack their shells.

In another demonstration, this time to illustrate its powerful torque, the tool draws the panels down on two walnuts until their shells crack.

Reportedly, an electric screwdriver with such a range of torque and speed control has been hitherto impossible.



Type XS

A SINGLE-VENTED

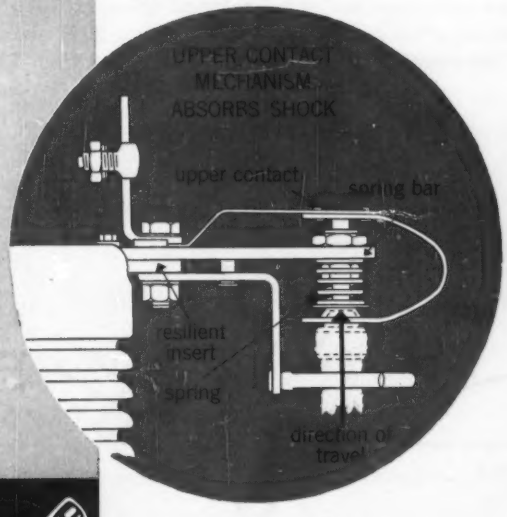
open cutout

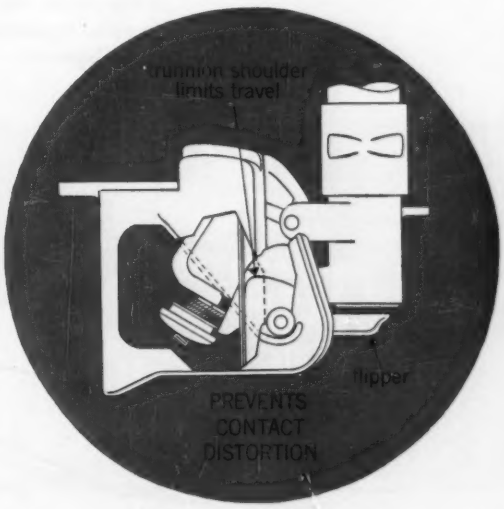
that will clear 12,000 amperes!

Significant new* developments by S&C now take the open cutout to exceptionally high levels of interrupting capacity without sacrificing low fault current interruption ability, without added cost, without double venting, and without disregard for linemen's safety.

- ✻ Controlled placement of fuse link shortens arc length — reduces gas generation.
- ✻ Multistep recoil action (from recoil bar, spring, resiliently mounted insert, contact) absorbs energy when fuse blows.
- ✻ Supplemental recoil action, when trunnion engages hinge casting, dissipates remaining energy.

The XS may be closed on 12,000 ampere faults (7.5 kv rating). And the patented "flipper" feature assures reliable interruption of low-current faults.





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Specialists in High-Voltage Circuit Interruption since 1910

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BUSINESS OUTLOOK

Electrical World
DECEMBER 31, 1956

Industrial production next year seems bound for new records. The Federal Reserve Board's index will probably average out around 148 compared with 143 this year, and last month's index of 147.

A rundown of major industries indicates that only a handful are likely to suffer setbacks during the next 12 months. Those that will are generally super-sensitive to the decline in housing starts—the furniture and lumber industries, for instance. (Housing starts will be off possibly 70,000 units this year.) Elsewhere the continued boom in capital investment, government spending on public construction and defense and the steadily improving financial position of consumers should lead to heightened production activity.

• • •

Steel backlogs are large now, and consumers will need even more next year. That means that output may tip the scales at 120 million tons and, for the year as a whole, keep the mills running at 90% of capacity. Nonferrous metals, too, will be in substantially stronger demand.

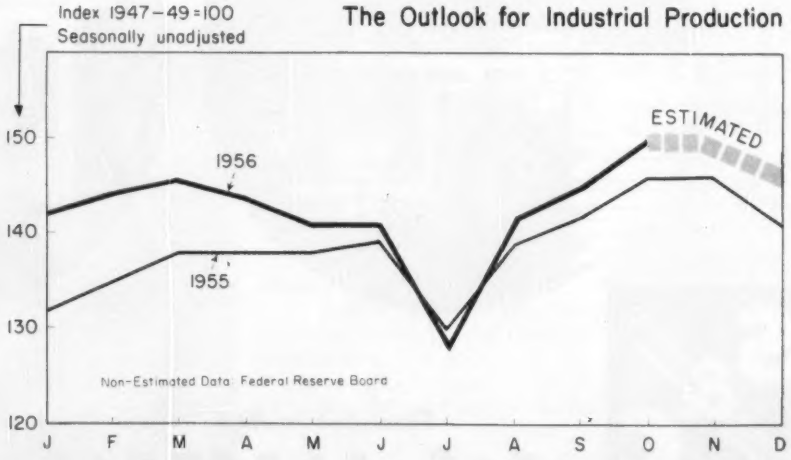
Chemical production will probably outstrip this year's record by 6%. Petroleum refiners, in the face of heightened demand from Europe as well as here, will scale production up by as much as 7%. The demand for industrial fuels will run along with the increased pace of industrial activity here. And in Europe fuels will be needed, in lieu of mid-Eastern supplies, to keep industry running. More gasoline will be required to fuel a mobile America that will run over 56 million cars before the year is out.

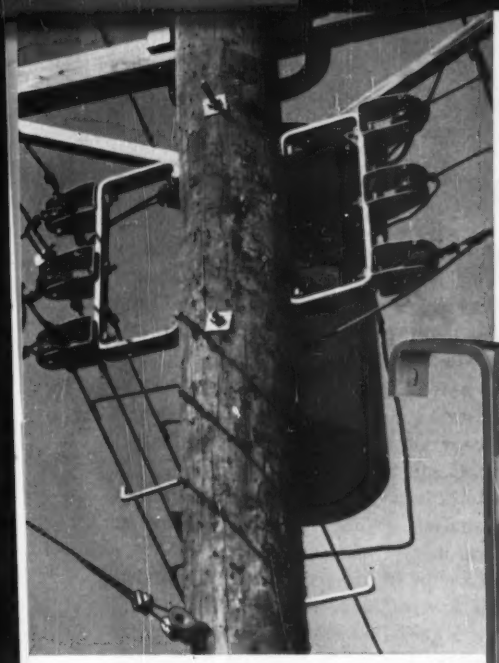
Paper production, another of the industries that rides the coattails of a general production increase will rise by possibly 5% during the year.

• • •

The enormous expansion plans of the utility industry are a big factor that will keep the production of heavy electrical apparatus strong this year and, on the basis of current backlogs, probably well into next. Sales of other types of equipment that are undergoing major technological advances will also shape up well. New orders for office machinery are now running 20% above a year ago. Shipments of instruments and controls will possibly work out 25% over last year.

The Outlook for Industrial Production





use CHANCE Pole Line Hardware

For Advanced Engineering Design
For Perfect "Pre-Checked" Fit
For FAST SERVICE ON DELIVERIES

The Seyler Manufacturing Company became part of the A. B. Chance Company about a year ago. Since that time Chance engineering experience and facilities have been used to develop new hardware products and to improve the many workaday pole line hardware items used by the electrical industry.

All Chance hardware is pre-fit. Nuts are checked against bolts . . . bolts against holes—you get the perfect fit that saves your line crews time.

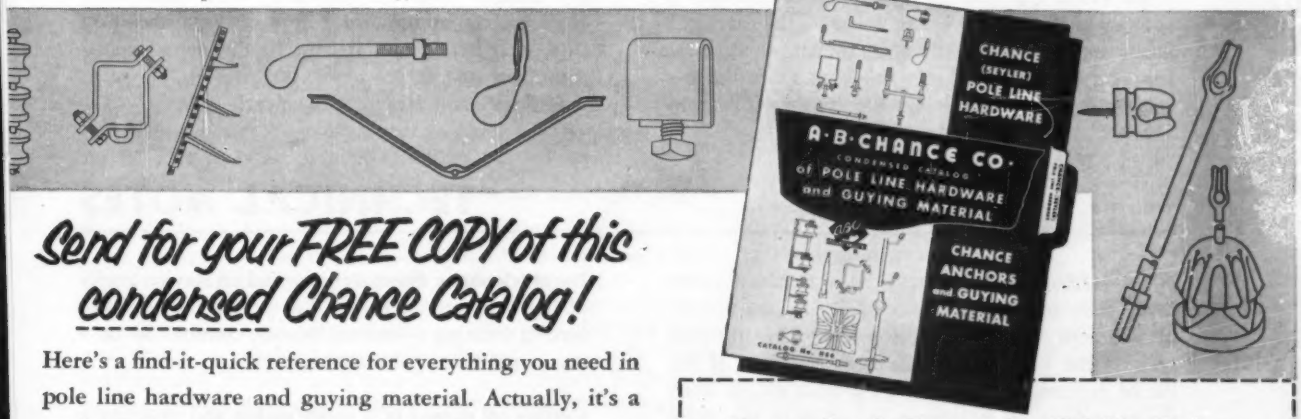
Chance hardware meets all applicable EEI specifications.

You get *fast service* on deliveries because Chance Pole Line Hardware is available from the local warehouses of Chance Distributors throughout the country. These stocks are backed by large inventories quickly available from Chance plant warehouses in Pittsburgh, San Francisco and Centralia. Your largest orders can be readily filled without delay.

Specify *Chance* for sound design, high quality and fast service.

Secondary Extension Bracket

Here's a new addition to the Chance hardware line. This secondary extension bracket is more economical than a secondary rack with separate extension between secondary conductors and the outside diameter of transformer tanks—and it leaves plenty of climbing space on the pole.


CHANCE (SEYLER) POLE LINE HARDWARE
A·B·CHANCE CO.
CONDENSED CATALOG
of POLE LINE HARDWARE and GUYING MATERIAL
CHANCE ANCHORS and GUYING MATERIAL

Send for your FREE COPY of this condensed Chance Catalog!

Here's a find-it-quick reference for everything you need in pole line hardware and guying material. Actually, it's a combination catalog and file folder. You'll like the way the information is arranged to help you find what you want quickly and easily.

CP56-25

Please send me the Chance *condensed* Pole Line Hardware and Guying Material Catalog.

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ADDRESS_____

COMPANY_____

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ABC INDUSTRIES

A·B·CHANCE CO.

CENTRALIA, MO., San Francisco, Cal., Pittsburgh, Pa.

IN THE INDUSTRY

Column Bows Out With Material Left Over

With this end-of-the-year column, **In The Industry** folds its tent and quietly fades away. For nearly nine years now this column has good-naturedly shared a page every other week with our old friend down at the bottom—Technical Notes. Next week Electrical World goes to a straight, full weekly magazine and **In The Industry** loses its lease. Technical Notes, by the way, gets a full page in the new book. You'll find the notes under a new title, "Engineering Trends."

First Had Washington Flavor

In the Industry, as some of its followers will recall, has had some pretty good days during these nine years. Associate Editor Richard N. Larkin first used it March 6, 1948 for some sharp commentary on "Government-Get-The-Hell-Out-Of-My-Business Club." Dick had been writing the Washington Comment column and evidently felt the need for some space to share his thoughts. As might have been expected, those early columns had a distinctly Washington flavor.

During the early part of 1951, the column took on additional sharpness as Editor Fischer Black (now also publisher) used it to debate the recommendations of the President's Water Resources Policy Commission. He shared the space with Commission Chairman Morris L. Cooke who upheld the Commission recommendations. Kenneth Kost, now manager of production, conducted the column for analyzing contemporary developments in late 1951 and early 1952.

In 1952, the column began to be conducted anonymously thereby losing some of its personal flavor and perhaps a little of its punch. In the past few years a signed column has been more the exception than the rule. It has been mainly a column of offbeat news and commentary on the industry.

But in writing finis, we must conclude that it is easier to start a column of this type than to stop one. It's going to be pretty hard to close up our "Future" file—the one in which we keep material for future columns. Let's take a look at some of the items still remaining in it:

There's a copy of the public power pamphlet "The Case for Competition in Electric Power." It is a provocative little booklet and one that deserves some critical analysis. We've been wanting to get time to work on it.

There's also a copy of Morris L. Cooke's booklet, "Nasser's High Aswan Dam—Panacea or Politics." In this, Cooke argues that the proposed Egyptian dam is not feasible. Instead he proposes basin-wide development—an argument he made several times in this column in defending the President's Water Policy Commission Report back in 1951.

Maybe a Column on Insurance

Then there's also an item in our file that Cleveland Electric Illuminating is now providing travel insurance for its employees. That, along with some material on air travel safety, might have made a column.

There's a cryptic dispatch from Washington that the President's Committee on government contracts is working with northern and border-state utilities in an effort to remove any discriminatory employment practices that may exist. Once this has been done, the Committee will go on to work with southern utilities, says the dispatch. We'd need some more specific information before we went ahead on that one. Better turn it over to the news department and just forget about it.

Farewell and Happy New Year!

TECHNICAL NOTES

Night loading of line trucks by warehouse crews saves thousands of dollars annually in one district of Southern California Edison Co. This practice reduces the waiting time the next morning. If the list of required materials for the next day is long, the crew foreman telephones his order to the warehouse during the afternoon.

Particles of 0.1 to 0.2 micron radius are the most difficult to participate from the air by electrostatic means.

Local telephone directory is carried on service trucks of Idaho Power Co so that the serviceman can save time in locating apartment houses, commercial concerns, and industrial plants.

Cutting off prongs of a series socket and inserting a plug separator converts small series street-lighting lamps to multiple for a few cents rather than replacing the entire fixture. A Massachusetts utility reports that this scheme appears satisfactory for most small series fixtures.

Rate-Changes Hold Year End Spotlight

Arkansas Power & Light, Public Service of Indiana, and Southern Indiana Gas & Electric receive increases. Other rates cut or revised during month

Rate changes in the industry hold the spotlight as the year 1956 draws to an end. These three electric companies have recently received increases in rates:

- Arkansas Power & Light Co, $1.5 million annually,
- Public Service Co of Indiana, $3.6 million annually, and
- Southern Indiana Gas & Electric Co, $1.2 million annually.

The Arkansas Public Service Commission on Dec. 14 decided that the Arkansas Power & Light Co is "entitled to relief" and ordered rates to be increased by two mills, or $1.5 million yearly. PSC based its action on an interim report of findings in the "cost of service study" presented Dec. 12 by James M. Honaker, Louisville, Ky., a consultant employed by the commission to examine the company's rate structure.

Means 30¢ a Month Rise

The company started billing under the new rates on Dec. 17. The change amounts to 30¢ a month for 150 kwhr, the approximate average consumption for residential customers. Because of the lower usage, 51% of all home users will get an increase of 20¢ or less per month. Maximum increase for any customer will be $4 a month. This is because a fuel adjustment of about two mills per kwhr for all usage in excess of 2,000 kwhr monthly has been in effect since July 1.

Based on his findings to date, Honaker recommended the two mills per kwhr increase to give the company relief until his final report is made early in 1957. Honaker is conducting the cost study in cooperation with the staff of the commission to determine the "equitable distribution of the cost of serving each class of customers."

Honaker said that he had studied the company's revenues and expenses from Oct. 1, 1955 to Sept. 30, 1956—a test period used for the analysis. During this period, he found that the company's earnings had declined to 4.88% on a net plant rate base, and to 5.07% on capital investment. This compared with a traditional return of 6% allowed by the commission.

This decline was attributed to increased fuel and labor costs and to the fact that about $4.6 million which was on the books as construction is now plant in service on which earnings are permitted.

It is estimated that the increase of two mills per kwhr would raise the rate of return to 5.15% on net plant rate base, and to 5.35% on invested capital.

Rural Co-op Rates Up

The Public Service Co of Indiana has received a $3.6 million annual rate boost, averaging 5.35% for all classes of customers, under a recent decision of the Indiana Public Service Commission.

The company has been charging the 5.35% across the board as a surcharge on bills, under a court order, but the recent commission order alters the increase in two ways.

First, it includes a $160,000 rate boost for rural electric membership co-operatives served by the company. Previously, their rates had not been increased. New rates will be upped so that these co-ops buying power from the company will pay a rate equal to the amount that rural customers directly served by the company pay. The rate increase in this case is 4.8%.

Increase Averages 5.35%

Second, a 500-page rate schedule filed by the company will now go into effect, with 5.35% over-all boost distributed among all customers, some paying less than the 5.35%, others more.

The Southern Indiana Gas & Electric Co has obtained a $1.2 million a year rate increase on a system-wide basis from the Indiana Public Service Commission.

These two will reduce rates:

Hopkinsville, Ky., Electric Plant Board will cut rates nearly $75,000 annually. Residential rates will be cut $43,000 a year; Commercial rates, $21,000; industrial rates, $9,300 and the city's street lighting will go down $1,000.

The Conway Corp, Conway, Ark., lessee of the city-owned light plant, will make changes in the commercial rates beginning January 1.

Walter Scales, plant manager, said the present commercial rate structure is made up of three different rates covering commercial lighting, power and refrigeration. It has been necessary, he said, to meter the different types of service and for the consumer to have separate wiring.

The new rate structure, according to Scales, is a mean or an average of the three rates now in effect. The new schedule starts at 6¢ a kwhr and reduced by blocks to 2¢. The old rates started at 8¢ and reduced to 2.2¢. Scales said that residential rates will not be affected.

In Walnut Ridge, Ark., the City Council has voted unanimously to appoint a committee of 25 businessmen to make a study of power rates of Arkansas-Missouri Power Co and to investigate the possibility of municipal ownership and operation of a power plant.

City Ponders Franchise

The City Council wrote recently to the Arkansas Power & Light Co, whose franchise extends to cities and towns in neighboring Jackson County, to inquire if the utility would be interested in coming into this area when the existing Arkansas-Missouri Power's contract expires.

R. E. Ritchie, Arkansas P&L president, replied to the effect that under the Arkansas law areas are allocated to the utilities by the Public Service Commission. Under present allocation Walnut Ridge, he said, was outside his company's territory and he did not believe it would be possible for AP&L to service this Lawrence County town.

In his letter, Ritchie told the City Council that the existing contract be-

tween the City of Walnut Ridge and the Arkansas-Missouri Power Co provides that the utility pay the city 5% of its annual gross revenue (exclusive of municipal and industrial accounts) in exchange for the right to sell power.

Calif. Utility Plans $220 Million Financing

Southern California Edison Co's Pres Harold Quinton has announced that the company will need $100 million in "new money" in 1957 and $120 million in 1958 to help finance record construction expenditures.

The utility's plant budget for 1957 has been upped by $13 million from previous estimates, and now stands at a record $135 million. He said that $10 million of the increase will go for initial construction of Edison's Mammoth Pool Hydro Plant in the high Sierra's. Government approval of the $47 million project is expected soon.

For 1958 the budget is set at $161 million, Quinton said, which includes another $32 million on Mammoth Pool and about $33 million on the planned 200-mi pipeline to bring gas into the Los Angeles area from the San Joaquin Valley.

Edison's president said that the utility plans to rely chiefly on bond and preferred stock issues to obtain the needed capital.

"I'd expect to pay from ¾ to one percentage point more for money in the near future than we have for some time past," he continued. "A little over a year ago, we sold bonds at 3.20%. Right now, we probably couldn't do better than 4.20%. Our last preferred issue cost us 4.21%. Today I don't think we could do less than 4.90 on a preferred issue."

Area Development Push

Residents of Plymouth, Wis., have agreed for the Wisconsin Power & Light Co to add a 50¢ a month charge on their bills to pay for industrial promotion. Commercial users will pay $1 a month. The plan was approved in a referendum, 1,309 to 597. Plymouth's Howard Fischer said that "we had a lot of inquiries from firms about locating in Plymouth but had nothing to nail down the deals with."

Idaho Power to Spend $47 Million

Idaho Power Co has asked the Securities and Exchange Commission for permission to register $20 million of first mortgage bonds due in 1987, and said in its request that the company wants to spend $47,184,000 on construction in 1957.

The construction includes work on Brownlee Dam, first project in the series of three low dams in Hells Canyon on the Snake River that the Idaho Power Co will build.

The company has already spent $10 million on the $64 million Brownlee Dam, and has invested $1.5 million in preliminary engineering on the Oxbow project, which will cost a total of $23 million. But no work has been accomplished at the Hells Canyon site itself, furthest downstream of the three projects, and one that will cost $46 million.

The company said it would offer the first mortgage bonds for public sale at competitive bidding and would use the proceeds to pay off short term bank loans estimated at $17.4 million. Remainder will be used in other construction.

Meanwhile the power company awaits a verdict of the Department of Interior on whether the federal government would build a high dam at Pleasant Valley. This decision should be announced shortly. Such a dam on the Snake would flood out the power company's low head dam at Hells Canyon. The original Pleasant Valley proposal would have given 500,000 acre ft of storage on the Snake, with the backwaters lapping against the Hells Canyon Dam which Idaho Power has permission to build. However, the recent idea to increase the height of the Pleasant Valley Dam would raise storage to 2.5 million ft and completely knock out Idaho Power.

FINANCE & REGULATION BRIEFS

Oklahoma Gas & Electric Co will pay Jan. 30 a quarterly common stock dividend of 45¢ a share as compared with 42½¢ in the previous quarter.

Residential customers of **Clark County,** Wash., **Public Utility District** no longer are required to pay $1 demand charge for each kilowatt over 20 kw. The charge has been dropped because so few customers go over the allowable 20 kw, the accounting expense is not worth the revenue. Commercial customers, however, will continue to be charged the $1 per kw demand charge for amounts in excess of 10 kw at one time, according to Cecil Penney, commercial manager.

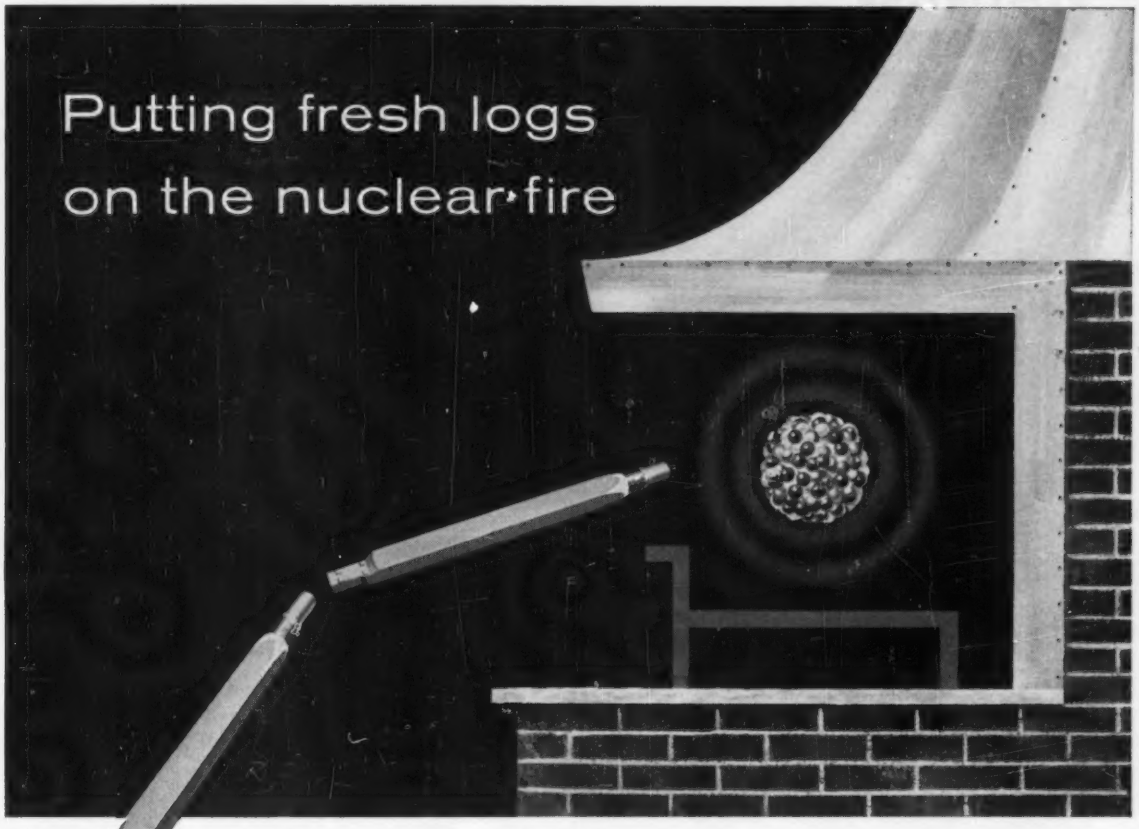
Secondary Offerings—Lehman Brothers has sold 50,000 shares **Potomac Electric Power Co** common stock at $21.125 a share; White, Weld & Co, 78,750 common shares of Consumers Power Co at $45.50; Smith, Barney & Co and Piper, Jaffray & Hopwood, 31,500 shares of common stock of Northern States Power Co at $17.25 a share, and Lehman Brothers and Robert W. Baird & Co, 36,300 common shares of Wisconsin Electric Power Co at $32.375. Smith, Barney & Co has offered 11,000 common shares of Iowa Electric Light & Power Co at $29.75.

Detroit Edison Co has announced that preliminary estimates indicate that about 28% of the dividends paid by the company in 1956 will be excludable from the stockholders' gross taxable account for federal income tax purposes.

Future Financing—Illinois Power Co will sell 200,000 common shares soon . . . Northwestern Public Service Co will offer to its stockholders rights to subscribe to 54,120 common shares at the rate of one new share for each ten shares now held.

Wyoming's permanent state legislative interim committee reported recently that it saw no reason for re-establishment of a property tax exemption for rural electrification associations. Committee noted that a study is being made by REA groups to see if a "density factor" cannot be worked out which would have a bearing on the assessed valuation of REA properties to provide relief for those organizations hard pressed by the taxation.

Putting fresh logs on the nuclear fire

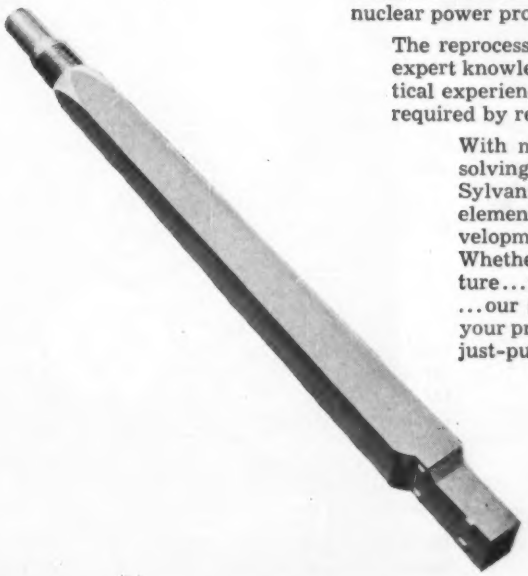


Like the logs in a fireplace, the fuel of a nuclear reactor "burns out" after a time. By-products, created by irradiation, "clog" the atomic structure of the fuel element, and the release of heat energy diminishes.

When reactor fuel reaches this stage, it must be reprocessed in order to reclaim the valuable fissionable materials remaining. In this way nuclear power production can be maintained economically.

The reprocessing of spent fuel elements is a task that requires expert knowledge, specialized equipment, and considerable practical experience. It is, in general, an outside service that will be required by reactor operators.

With more than eight years of successful experience in solving advanced technical problems in atomic energy, Sylvania has long been a leading processor of reactor fuel elements and assemblies, as well as a pioneer in the development of fuel elements and reprocessing techniques. Whether your reactor plans are immediate or for the future... for power or research... international or domestic ... our scientific and engineering staff will gladly discuss your problems with you. For your files, write for Sylvania's just-published booklet on Nuclear Fuels.



SYLVANIA

ATOMIC ENERGY DIVISION

SYLVANIA ELECTRIC PRODUCTS INC.
Atomic Energy Division, P. O. Box 59, Bayside, New York
In Canada: Sylvania Electric (Canada) Ltd., Shell Tower Building, Montreal
Sylvania International Corporation, 14 Bahnhofstrasse, Coire, Switzerland

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Analysis of Fuel Used For Generation by Electric Utilities—1955

(Fuel Burned Under Boilers and by Internal Combustion Engines)

	BTU per Net Kwhr	Cost per Million BTU Consumed	Cost of Fuel per Net Kwhr	% Net Fuel Generation Reported	Average Cost per Million BTU Consumed		
					Coal (a)	Oil (b)	Gas (c)
United States	11,699	24.3¢	.28¢	95.2	24.9¢	33.6¢	18.7¢
New England	12,832	36.0	.46	98.1	35.3(d)	37.1	36.8
Middle Atlantic	11,897	29.3	.35	98.7	28.4	35.9	30.5
E. North Central	11,485	23.8	.27	96.1	23.8	76.5	14.6(e)
W. North Central	13,520	24.7	.33	74.9	26.4	36.4	22.4
South Atlantic	11,213	27.1	.30	95.2	25.9	36.3	24.2
E. South Central	10,408	18.1	.19	98.7	18.1	41.7	18.3
W. South Central	12,532	11.3	.14	91.5	28.4	30.2	11.1
Mountain	13,292	21.6	.29	92.9	20.7	26.5	21.5
Pacific	11,827	26.3	.31	98.7	14.4 (f)	28.0	25.5

(a) Coal includes bituminous and anthracite coal, and relatively small amounts of coke, lignite, wood and corn residue; (b) Oil includes fuel oil, crude oil, and small amounts of tar and gasoline; (c) Gas includes natural and manufactured gas and waste gas; (d) Includes bbl. of oil converted to equivalent tons of coal; (e) Includes blast furnace gas; (f) Cord-foot cubic feet of hogged wood converted to pounds and tons.

Source: Edison Electric Institute

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Oct.	119.38	118.66	112.13	6.5
Peak—Class 1 Systems (million kw)	Sept.	96.5	98.0	90.1	7.1
Estimated Dec. '56 Peak (million kw)	Sept.	106.17	106.10	104.31	1.8
Production—billion kwhr	Oct.	51.13	48.82	47.70	7.9
Hydro		9.24	8.96	8.80	4.9
Fuel		41.89	39.86	38.60	8.5
Sales—billion kwhr	Sept.	46.07	46.11	43.39	6.2
Residential		11.68	11.60	10.63	9.9
Commercial		7.82	7.95	7.36	6.3
Industrial		23.86	23.78	22.72	5.0
Other		2.72	2.78	2.68	1.5
Fuel Consumption	Oct.				
Coal—million tons		13.52	12.45	12.65	6.9
Oil—million barrels		6.27	5.20	6.04	3.8
Gas—million cu ft		114.36	124.63	104.80	9.1
Net Income Class A & B Co's—$ million	Sept.	108.45	97.17	100.18	8.3
Residential Customers—millions	12 mos.	45.39	45.25	44.09	2.9
Revenue per kwhr	ended	2.61¢	2.61¢	2.66¢	−1.9
Avg kwhr per customer	Sept. 30	2,929	2,914	2,700	8.5
Avg annual bill		$76.45	$76.06	$71.82	6.4

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Nov.	149	150	144	3.5
ENR Construction Cost	Dec.	147.6	147.6	141.1	4.6
BLS Cost-of-living	Oct.	117.7	117.1	114.9	2.4
New Orders for Machinery (1950 = 100)	Oct.	137.0	136.0	130.0	5.4
NEMA Sales					
Insulation materials	Oct.	170	147	156	9.0
Electric appliances		94	101	96	−2.1
Wholesale prices	Sept.				
Motors and generators		136.2	133.3	125.1	8.9
Transformers and regulators		144.8	139.7	129.2	12.1
Switchgear and fuses		157.0	153.8	146.1	7.5
GNP—annual rate—$ billion	3rd Qtr.	413.8	408.3	396.8	4.3

WHEN SPACE IS PARAMOUNT

New Switch Design For Moloney Network Transformers Saves Installation Space

You gain 5 inches of valuable vault space because Moloney's new high voltage switch is now 5 inches narrower than formerly. This results in an overall reduction in the length of network transformers, and permits more work space in old vaults . . . or reduces excavation costs on new vaults.

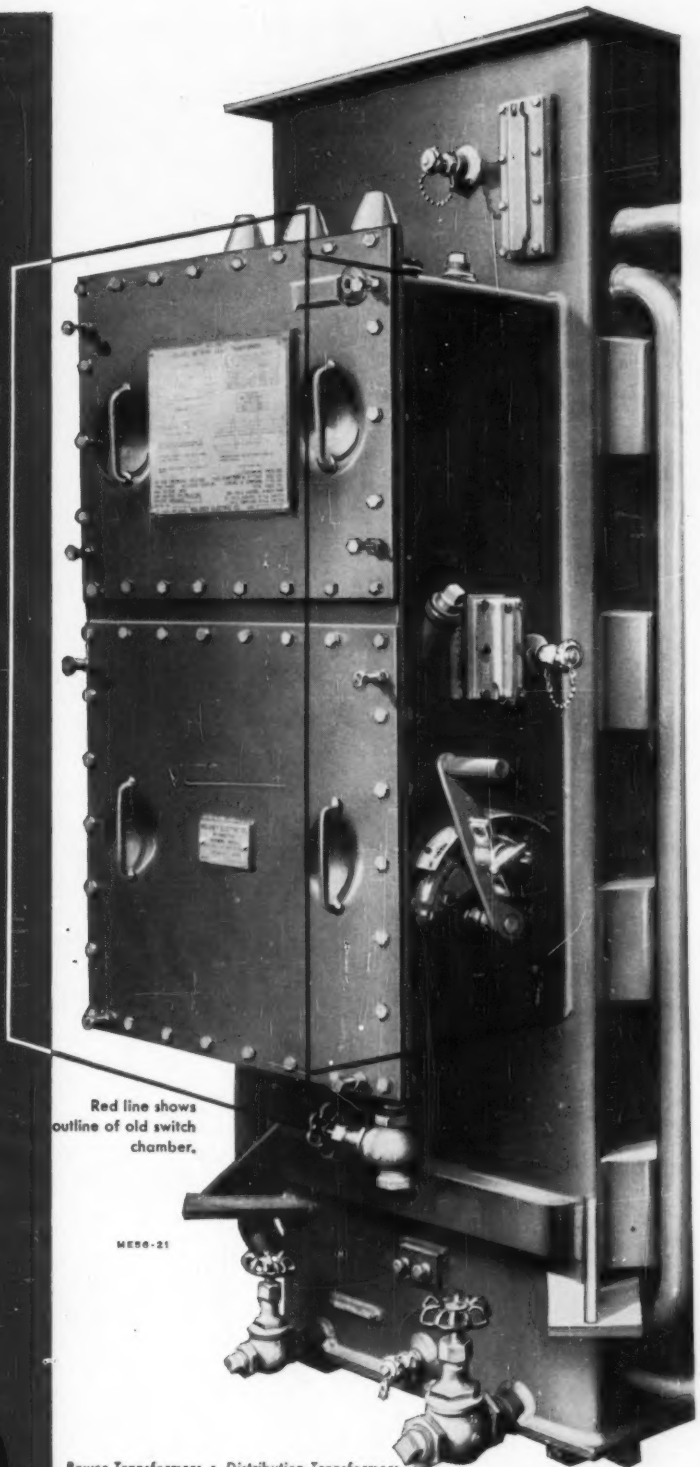
Moloney's new switch has the same liberal current carrying capacity as formerly. Electrical clearances have not been altered. In every way, Moloney's new switch meets NEMA standards fully . . . PLUS Moloney's own high standards of performance dependability.

Save space. Save money. SAVE SPACE. Specify Moloney Network Transformers. They're engineered to provide dependable, continuous service for your network system.

MOLONEY ELECTRIC COMPANY

All Moloney Network Transformers feature positive, load break, high voltage switches that conform to NEMA standards.

MOLONEY ELECTRIC



Red line shows outline of old switch chamber.

ME56-21

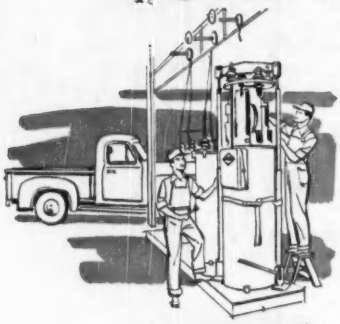
Power Transformers • Distribution Transformers
Load Tap Changing Transformers • Regulating Transformers • Step Voltage Regulators
Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers • Industrial Dry Type Transformers • Capacitors • Transformers and Inductors for Electronics

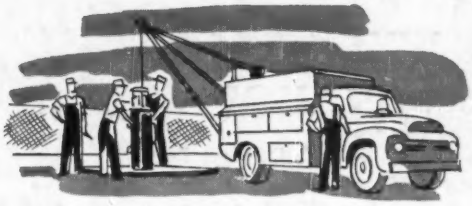
FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CAN.

How to Reduce Regulator Service Costs

Compare

Servicing Allis-Chalmers Regulators **vs** **Servicing Other Regulators**





1—Drain oil from tank

2—Remove cover, bushings and control leads

3—Piecemeal untanking

LIVE BETTER ELECTRICALLY

Unit Construction of Allis-Chalmers Regulators makes startling savings possible

A 2-man crew arrives in a pickup truck, switches the regulator off the line and sets up the hydraulic jack. In a matter of a few minutes the entire mechanism is lifted far enough out of the tank for inspection. Even the bushings remain in place.

There's no need for a large crew and expensive equipment to move regulator and service it.

This is just one of many savings using Allis-Chalmers regulators. For the complete story, call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

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